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SEA FIGHTER ANALYSIS

SUMMARY REPORT

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16. Abstract (MAXIMUM 200 WORDS)

The U.S. Coast Guard (CG) Research & Development Center (R&DC) evaluated the U.S. Navy's Sea Fighter vessel (FSF-1) for potential applicability for CG missions. For this evaluation, the project team used a combination of engagement modeling and simulation (M&S), human systems integration (HSI) modeling, and Sea Fighter crew and shiprider insights.

Specifically, the R&DC evaluated four Sea Fighter attributes that could significantly impact CG mission effectiveness: A maximum rate of speed (50 kts); multiple deployable surface and air assets; small crew size (26); and a reconfigurable mission bay (accommodates 12 mission modules). This report analyzes and discusses the findings of these evaluations, draws conclusions from the findings, and makes recommendations concerning future application of Sea Fighter's organic capabilities.

Additional technical information that was developed in conjunction with this evaluation can be found in appendices B-E attached in electronic format.

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EXECUTIVE SUMMARY

Introduction/Objective

The U.S. Coast Guard (CG) Research and Development Center (R&DC) evaluated the U.S. Navy's Sea Fighter vessel for potential applicability to CG missions. When compared to other CG cutters, Sea Fighter has four unique capabilities/characteristics that could significantly impact CG mission effectiveness:

- High-speed (50 kts)
- Multiple deployable surface and air assets (three 11m Rigid Hull Inflatable Boats (RHIBs) (Cutter Boats Over-The-Horizon (CB-OTH)) or five 7m RHIBs (Short Range Prosecutors (SRP)), two HH-60s or two HH-65s, and multiple Vertical Unmanned Aerial Vehicles (VUAVs))
- Small crew size (26 persons)
- Reconfigurable Mission bay (accommodates 12 mission modules)

Methodology

This project evaluated Sea Fighter's unique capabilities through a combination of engagement modeling and simulation, human systems integration modeling, and Sea Fighter crew and shiprider insights (following multiple R&DC operational test and evaluation exercises).

Results

High-speed and multiple deployable assets were evaluated using engagement modeling. Scenarios were developed to simulate fishing-like vessels (lower speed with higher density) and drug smuggling-like vessels (higher speed with lower density). The results of the analysis showed that by themselves high-speed and multiple deployable assets made little improvement in mission effectiveness. However, as Sea Fighter's sensor detection range and/or its off-board detection capability (a vital contributor to maritime domain awareness (MDA)) improved, high-speed and multiple deployable assets did lead to significant improvements in mission effectiveness. In the simulated scenarios, improving components of MDA (off-board detection capability) was the critical performance driver, followed closely by increasing intercept speed (from 30 to 50 kts) and increasing the number of deployable assets from two to four (particularly increasing the number of deployable helicopters). These improvements result in an almost 30 percent increase in the number of high-speed targets that can be boarded.

Crew size, required functions, and fatigue associated with a typical CG patrol were evaluated through human system integration (HSI) modeling. With Sea Fighter's highly automated bridge and engine room, a 26-person crew can sustain many of the required functions. For a typical 14-day patrol, Sea Fighter's crew could sustain normal Condition-3 watches, multiple boardings (some simultaneously), and multiple VUAV launches. However, HSI modeling showed that Sea Fighter's crew could not sustain regularly scheduled helicopter flight operations.

To account for these deficiencies, the crew was optimized by adding two boatswain mates and a six-person detachment—Law Enforcement Detachment (LEDET), Maritime Safety and Security Team (MSST), or Maritime Security Response Team (MSRT). This 28+6 optimal crew was able to sustain all required functions. In a typical 14-day patrol scenario, the 28+6 optimal crew averaged three boardings, two helicopter sorties, and three VUAV sorties each day without exceeding acceptable fatigue levels.

Finally, crew and shipriders provided firsthand observations and insights relative to Sea Fighter's unique capabilities. Some key insights are:

- High-speed capability is a distinct advantage in a vessel accomplishing any law enforcement mission and is especially effective at intercepting fast, evasive, and uncooperative targets.
- Sea Fighter's ride quality at low speed (less than 15 kts) is very poor and can adversely affect operations or activities; however, ride quality significantly improves at higher speeds (20+ kts). The trade off is largely due to hull design consideration made during Sea Fighter's planning phase.
- RHIB launch and recovery is limited to 5 kts due to the poorly designed stern ramp and vessel movements at low (less than 15 kts) speeds.
- A crew of 26 is too small for typical CG operations.
- Overall, ship layout and configuration are excellent. Bridge layout affords excellent visibility, internal communications, and improved situational awareness with all underway watchstanders located on the bridge. Flight deck lighting, configuration, and manning are exceptional from both a crew and pilot perspective.
- Sea Fighter's mission bay can provide remarkable mission flexibility, especially for deployable teams such as MSRTs or MSSTs. However, spaces for 12 mission modules seem a bit excessive for CG needs. In addition, the design of the X-Y crane prohibits moving payloads (including extra 11m or 7m RHIBs) while underway.

Conclusion

A 50-kt Sea Fighter-like vessel with four deployable assets (two 11m OTH RHIBs and two HH-60 helicopters) can provide significant performance improvement compared to a traditional 30-kt CG vessel (CG High-Endurance Cutter (WHEC) or CG Patrol Boat (WPB)).

A highly automated Sea Fighter-like vessel, with the crew size of a patrol boat, provides more mission capability than a WHEC. The ModCAT hullform and large mission bay provide excellent flexibility for emerging CG missions and demands. Sea Fighter's speed and multiple deployable asset capability offer outstanding performance improvement potential for the CG; however, a critical enabler is improving detection capabilities – an element of maritime domain awareness. As MDA improves, a 50-kt patrol vessel capable of deploying four assets could provide a tremendous improvement over current and future 30-kt vessels.

Recommendations

The CG needs to continue to evaluate non-standard hull forms such as ModCAT-type vessels for both speed and modularity purposes. High-speed vessels normally have endurance problems based on their fuel consumption rates. This has been one of the perceived shortcomings of this hullform type. However, the ModCAT hullform (i.e. Sea Fighter) provides very good fuel economy and, given the typical patrol profile (12 kt patrol speed, 20 kt transit speed, and 50 kt intercept speed), the vessel is capable of remaining within the patrol area for an entire patrol period. Opportunities exist for the CG to further evaluate other Navy/DOD high-speed vessels (HSV) such as the M88 Stiletto for MSRT type missions and the HSV platforms, HSV Swift and HSV Joint Venture, for extended duration missions.

Additionally, the CG should look at ways to optimize the number and type of deployable and off-board assets through a more detailed M&S analysis. A 50 kt Sea Fighter-like cutter with four deployable assets (e.g., two 11 m OTH RHIBs and two HH-60 helicopters) can provide significant mission performance improvement compared to a standard 30 kt cutter. To maximize the benefit from embarking four deployable assets (two 11 m OTH RHIBs and two HH-60s), a revised approach to boardings would need to be established. Currently, boardings are to be conducted within two hours from the WHEC (at the WHEC's maximum speed). Under the MSRT CONOPs, the boarding teams would need to be trained similar to MSRTs which are able to defend themselves while conducting a boarding at greater distances from the patrol vessel.

The CG needs to continue to incorporate more automated systems on-board cutters, but have contingency plans (both personnel and equipment) in place for changes in operational requirements or causalities. In order to derive optimal mission effectiveness, the patrol cutter must be able to safely navigate and operate deployable assets in varying sea states and at a reasonable speed. Sea Fighter's automated systems allow for these evolutions to be conducted with fewer crew members and with an acceptable margin for safety.

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LIST OF ACRONYMS

AFFF	Aqueous Film Forming Foam
AMIO	Alien Migrant Interdiction Operations
AVGAS	Aviation Gasoline
BM	Boatswain Mates
CB-OTH	Cutter Boats Over-The-Horizon
CG	Coast Guard
CG-37RCU-2	Cutter Platforms Division
COMMS	Communications
CONOPS	Concept of Operations
EOW	Engineer of the Watch
FSF-1	Fast Sea Frame-1
ft	Foot or feet
HH-60	Medium-range Recovery Helicopters
HH-65	Multi-mission Cutter Helicopters
HSI	Human Systems Integration
HSK	Helicopter support kit
IBNS	Integrated Bridge and Navigation System
ISO	International Standards Organization
kt(s)	Knot(s)
LCS	Littoral Combat Ship
LEDET	Law Enforcement Detachment
LSE	Landing Signal Enlisted
m	Meter or meters
M&S	Modeling and Simulation
MCS-5	Machinery Control System
MDA	Maritime Domain Awareness
MSRT	Maritime Security Response Team
MSST	Maritime Safety and Security Team
nm	Nautical mile(s)
NOW	Navigator of the Watch
NSC	National Security Cutter
ONR	Office of Naval Research
OOD	Officer of the Deck
OPTEMPO	Operations Tempo
OT&E	Operational Test & Evaluation
R&DC	Research & Development Center
RHIB	Rigid Hull Inflatable Boat
SOLAS	Safety of Life at Sea
SRP	Short Range Prosecutors
SWATH	Small Water-Plane Area Twin Hull
TCM	Total Crew Model
TEU	Twenty-foot Equivalent Units
USCG	U.S. Coast Guard
USN	U.S. Navy

VUAV	Vertical Unmanned Aerial Vehicles
WHEC	Coast Guard High-Endurance Cutter
WPB	Coast Guard Patrol Boat
WQ&SB	Watch, Quarters, and Station Bill

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1. INTRODUCTION

In 1998 the United States Navy (USN) Office of Naval Research (ONR) contracted with Nigel Gee Naval Architects to design a small, fast, highly capable Littoral Surface Craft with a calm water speed of 50 kts, a range of 4,000 nautical miles, unlimited operations in Sea State 4 (~ 8-foot seas), with maximum possible operations in Sea State 5 (~ 10-foot seas). Nigel Gee "modified" the design of a traditional catamaran and developed "ModCAT" to achieve improved seakeeping without a significant degradation to the ships powering. Essentially the high-speed qualities of a catamaran were merged with the seakeeping qualities of a Small Water-Plane Area Twin Hull (SWATH) design as seen in Figure 1.

Figure 1. Sea Fighter during construction (ModCat hull form visible).

ONR contracted with the Titan Corporation (since acquired by L3 Communications) to design and build the Nigel Gee designed ModCAT, artist rendering seen in Figure 2. The USN christened this vessel "Sea Fighter" Fast Sea Frame-1 (FSF-1). ONR developed an Operational Test & Evaluation (OT&E) program to fully assess Sea Fighter's capabilities/characteristics as a potential low-cost alternative for their Littoral Combat Ship (LCS) program.

Sea Fighter's Principle Characteristics

Figure 2. Artist rendering of Sea Fighter.

Table 1. Sea Fighter characteristics.

Length (overall):	79.9 m (262 ft)
Length (waterline):	73 m (240 ft)
Range:	4,000 nm @ 20+ kts
Light Ship Displacement:	960 metric tons
Full Load Displacement:	1150 long tons
Beam:	22 m (72 ft)
Draft:	3.5 m (11.5 ft)
Speed:	50 kts up to Sea State 3 40 kts in Sea State 4
Survivability:	Operational through Sea State 4; Survivable through Sea State 6
Mission Bay:	Support mission modules in ISO TEU (20'×8'×8' containers) Multipurpose stern ramp (launch/recover up to 11 m RHIBs) Side RO/RO ramp (support fully loaded HMMWV)
Flight Deck:	Landing spots for (2) SH-60Rs (day VFR; night NVD/NVG compatible) Refueling capability but no maintenance facilities (no hangar)
Crew:	26 (which includes 10 permanent Coast Guard crew members)

When compared to other U.S. Coast Guard (CG) cutters, Sea Fighter has four unique capabilities/characteristics that could significantly impact CG mission effectiveness:

High-speed

Sea Fighter can achieve 50 kts (sea conditions permitting). CG legacy and proposed Deepwater surface assets do not have this capability. Sea Fighter is seen conducting high-speed maneuvers in Figure 3.

Figure 3. Sea Fighter during high-speed maneuvering off the coast of San Diego.

Multiple Deployable Surface and Air Assets

Sea Fighter has the capability of deploying multiple 11 m rigid hull inflatable boats (RHIB), cutter boats over-the-horizon (CB-OTH) or 7 m RHIB short-range prosecutors (SRP), two medium-range recovery helicopters (HH-60) or two multi-mission cutter helicopter (HH-65) and multiple vertical takeoff and landing unmanned aerial vehicles (VUAV). Two HH-65C helicopters can be seen operating from Sea Fighter's flight deck in Figure 4.

Figure 4. Two HH-65Cs from Air Station LA conducting simultaneous flight operations on Sea Fighter.

Small Crew Size

Sea Fighter's capabilities are comparable to a CG High Endurance Cutter (WHEC), yet her crew size (26 personnel) is comparable to a CG Patrol Boat (WPB). The vessel is highly-automated, with all underway watchstanders located on the bridge. Figure 5 shows part of the integrated bridge console that allows for a 4-person watch section.

Figure 5. Sea Fighter's integrated bridge console.

Modularity

Sea Fighter can accommodate and quickly change-out up to 12 mission modules [20'×8'×8' International Standards Organization (ISO) Twenty-foot Equivalent Units (TEU) containers] in port. Each mission module can be outfitted with mission specific equipment to perform various operational functions.   Sea Fighter's mission bay, seen in Figure 6, is where mission modules for specialized teams such as Maritime Safety and Security Teams (MSST) and Maritime Security Response Teams (MSRT) could be deployed.

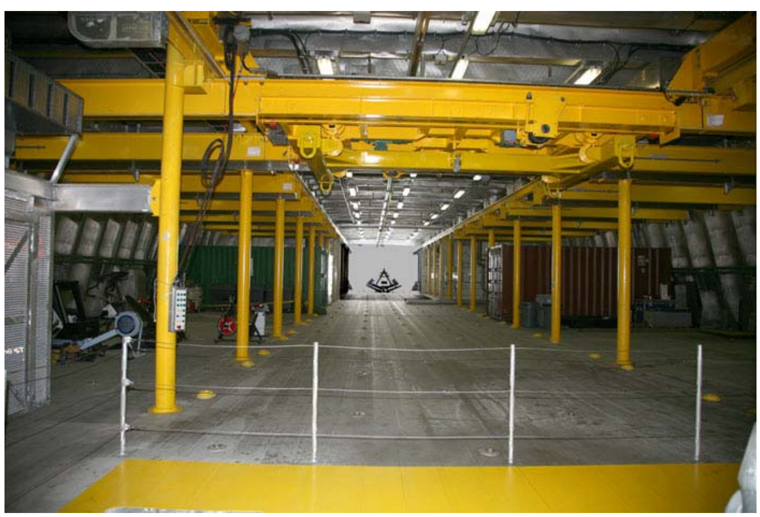

Figure 6. Sea Fighter's mission bay.

Since the inception of the LCS program, the USN and the CG have been discussing the potential applicability for CG missions. In 2004, ONR invited the CG to jointly evaluate Sea Fighter. The CG's Response Directorate, Chief, Cutter Platforms Division (CG-37RCU-2) was assigned as the Program Manager. CG-37RCU-2 leveraged support from the CG Research & Development

Center (R&DC) for the joint evaluation.

The CG provided 10 members of the 26-person crew, including the Executive Officer, for the evaluation of Sea Fighter. With a combined CG and Navy crew, the vessel was scheduled for 13 months of OT&E—8 weeks of which were allocated for strictly CG OT&E. The CG realized that 8 weeks of OT&E were too short to properly evaluate Sea Fighter's unique capabilities. Given Sea Fighter's status as an experimental vessel, the vessel could not be used to execute actual missions. In addition, it is costly and impractical to try to replicate many CG missions, demands, and operating environments.

In order to fully evaluate Sea Fighter's unique capabilities and their impact on CG missions, modeling & simulation (M&S), crew insights obtained through crew surveys/interviews, and contracted shiprider post-sailing reports were developed and studied.

- **OT&E** was used to evaluate the vessels' capabilities, such as speed in various sea states, stability, critical operating parameters, flight operations, launch and recovery of deployable surface assets, and typical shipboard evolutions.
- **Engagement M&S** was used to evaluate two of Sea Fighter's unique capabilities (*high-speed* and *multiple deployable assets*) in executing CG missions.
- **Human Systems Integration (HSI) M&S** was used to determine the capabilities and limitations of the 26-person crew on a highly automated vessel during a typical CG WHEC / national security cutter (NSC) patrol.
- **Crew Insights** were gained through surveys, interviews, and shiprider observations. The combined CG and USN Sea Fighter crew was on-board for the entire OT&E period and gained a wealth of knowledge about the vessel that was invaluable in the overall evaluation of vessel capabilities.

This technical report focuses on the evaluation of Sea Fighter's unique capabilities (*high-speed, multiple deployable assets, small crew size,* and *modularity*) through engagement M&S, HSI M&S, and crew insights. Conclusions integrate the findings from these three evaluation areas with findings from OT&E and engineering/physical reality.

2. ENGAGEMENT MODELING

Objectives and Approach

The objective of engagement modeling was to determine the impact of *high-speed* and *multiple deployable assets* on CG mission effectiveness. OT&E provided a means to verify and validate certain Sea Fighter characteristics, but did not provide a means to evaluate the impact those characteristics have on mission effectiveness. In addition, the aim of this type of modeling was not necessarily to model Sea Fighter exactly, but to model two of the unique aspects of Sea Fighter: *high-speed* and *multiple deployable assets*.

In this approach, the modeling environment was simplified and leveled so that the impact of *high-speed* and *multiple deployable assets* could be isolated and scrutinized. This "controlled" environment consisted of:

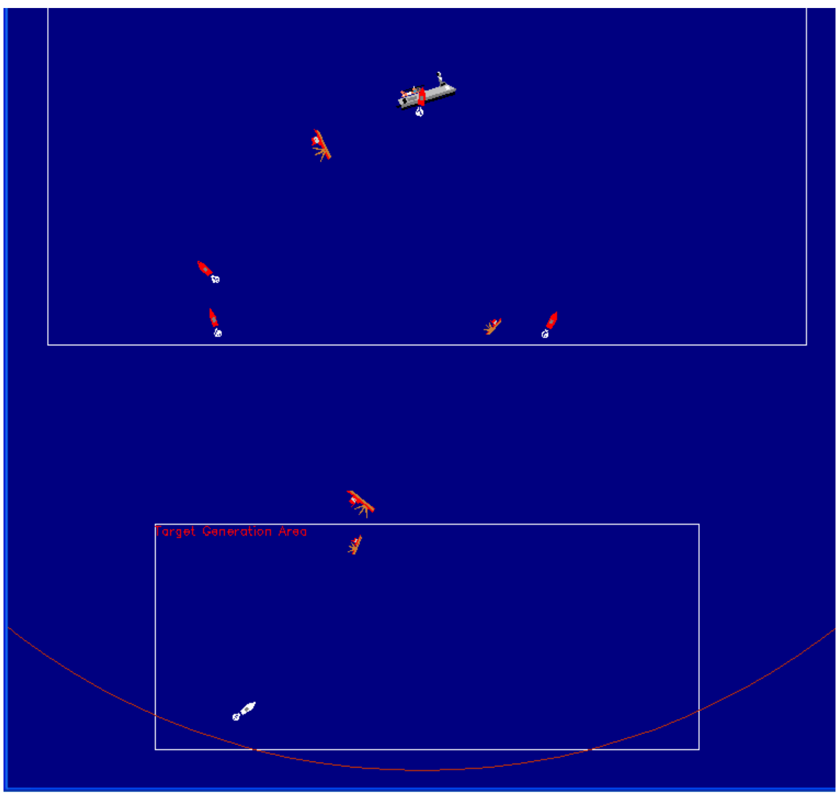

Figure 7. Visual representation of the modeling environment.

- A 160 nm by 350 nm operation area, shown above in the Figure 7; the lower box is the target generation area. The size of the operation area was based on the speeds of Sea Fighter and various targets.
- Calm seas and weather (Sea State 1).
- Sensors were used in daytime configurations only.
- A 14-day continuous patrol (Selected based on typical High Endurance Cutter patrol—14

days underway, mid-patrol break for replenishment, followed by another 14 days underway).

- Unlimited fuel. Although fuel was assumed to be “unlimited,” fuel was monitored in the model. Based on the operational profile of 12 kts patrol speed, 20 kts transit speed, and sprinting at max speed for target vessel intercepts, the Sea Fighter has sufficient fuel capacity to sustain a 14-day continuous patrol with more than a 10 percent fuel reserve upon arrival in port for the mid-patrol break.
- To evaluate mission effectiveness, two CG mission-like scenarios were developed:
  - **High-speed (35+ kts) targets/low density (2–5 targets in the patrol area per day).** This scenario corresponds to counterdrug, counterterrorism, and a small subset of Alien Migrant Interdiction Operations (AMIO) missions. In this scenario, Sea Fighter’s Concept of Operations (CONOPS) was to patrol using a random search, detect as many targets as possible, and where possible intercept and board those targets moving at a high-speed.
  - **Low speed (less than 15 kts) targets/high density (5–10 targets in the patrol area per day).** This scenario corresponds to fisheries and other missions that involve less evasive targets in greater numbers. In this scenario, Sea Fighter’s CONOPS was to patrol using a random search, detect, intercept, and board as many targets as possible.
- All targets were non evasive, and target capture was based on proximity of either Sea Fighter or deployed asset.

Additional details regarding the scenarios (including inputs, outputs, assumptions, variables, CONOPS, etc.) are contained in Appendix B.

During these studies, the M&S team conducted detailed reviews of the outputs. Models were either corrected/adjusted or validated for reasonableness. When the M&S team found outputs to be counterintuitive or intriguing, additional “follow-on” studies were conducted. The findings from these studies are discussed below.

Study Findings

Intercept Speed Study

An intercept speed study was used to determine the impact of cutter intercept speed on targets detected and boarded. The cutter’s surface search radar, with base ranges of 18 nm for high-speed targets and 24 nm for low-speed targets, was assumed to be the only means of detecting targets. Cutter intercept speeds were selected based on the maximum speeds of legacy cutters (20 kts), the planned Deepwater NSC (30 kts), and Sea Fighter (50 kts). Two surface boarding assets were used in all modeling runs. Figure 8 illustrates the impact of intercept speed on boarding and detection rates achieved during the modeling runs. These results are discussed below.

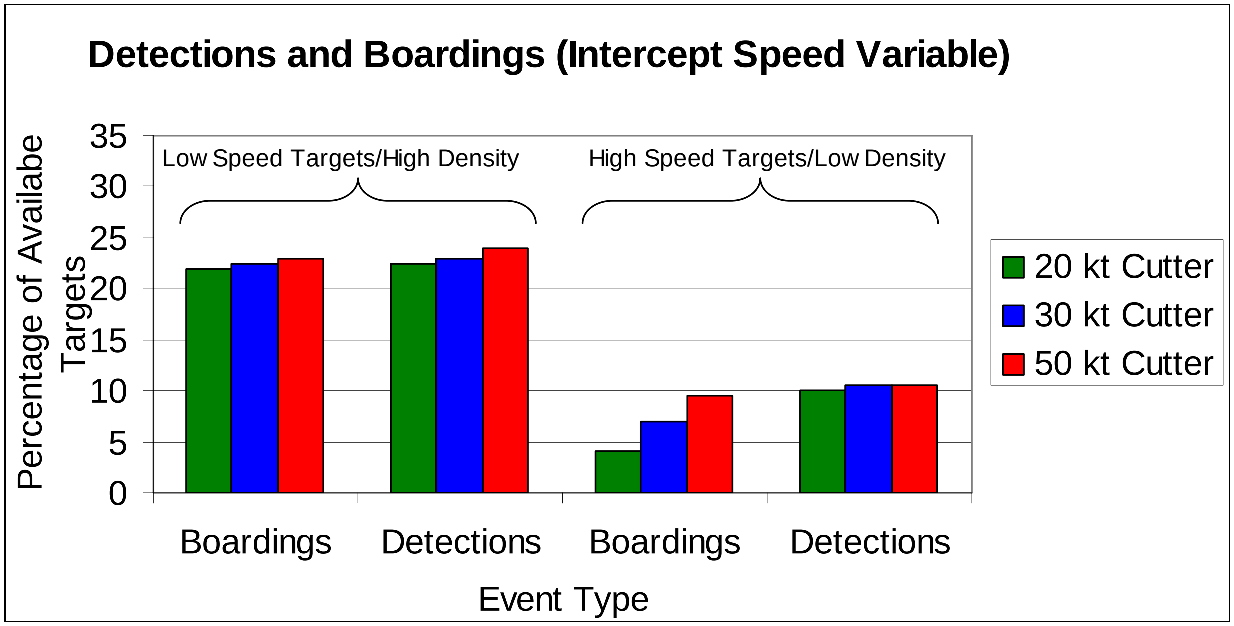

Figure 8. Cutter Intercept Speed verses targets detected and boarded.

<u>Intercept Speed Study Results:</u>

- Cutter intercept speed had little to no impact on targets detected (for both high- and low-speed targets).
- Cutter intercept speed had limited impact on low-speed targets boarded. The percentage of targets boarded increased from 22 percent to 24 percent as intercept speed was raised from 30 to 50 kts, (a 10 percent increase over the baseline value).
- Cutter intercept speed had a significant impact on high-speed targets boarded. The percentage of targets boarded increased from 4 percent to 9 percent as intercept speed was raised from 30 to 50 kts, (a 100 percent increase over the baseline value).
- The cutter sensor range alone provides limited detection capabilities, which in turn results in limited boardings.

<u>Intercept Speed Follow-on Study</u>

Given the cutter's inability to detect the majority of targets in the patrol area (regardless of intercept speed), a follow-on study was developed to determine the impact intercept speed would have with better on-board sensor detection capabilities.

Cutter Sensor Range Study

A cutter sensor range study was conducted to determine the impact on targets boarded with higher cutter intercept speeds given improved detection capabilities. Cutter sensor ranges were varied between base range, 2× base range, and 10× base range. Cutter intercept speeds were modeled at 20 kts, 30 kts, and 50 kts. Two surface deployable assets were used in all modeling runs. Figure 9 illustrates the impact of on-board sensor detection range and cutter intercept speed on boarding rates achieved during the modeling runs.

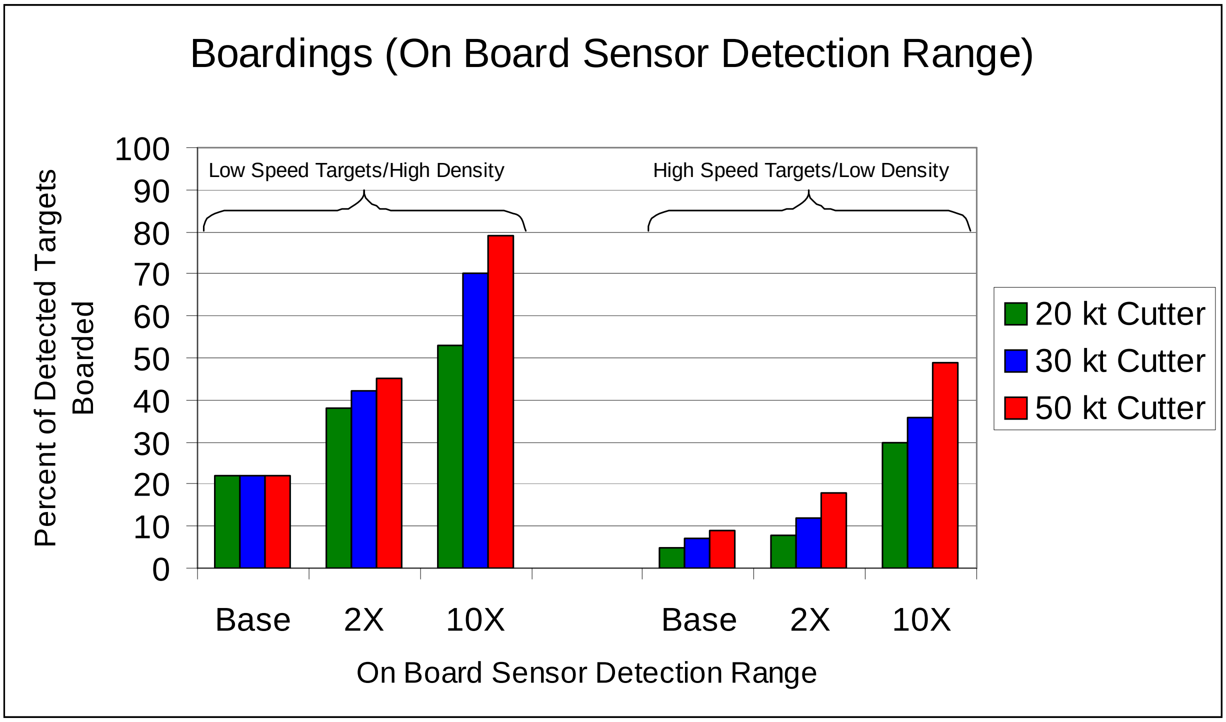

Figure 9. Cutter speed and on-board sensor detection range verses targets boarded.

Cutter Sensor Range Study Results (Low Speed Targets):

- As detection range increases, cutter intercept speed has a significantly greater impact on the percentage of boardings.
- With just a doubling of the cutter's sensor range, the percentage of targets boarded increased from 22 percent to 38 percent for a 20 kt vessel (an increase of 72 percent over the baseline), from 22 percent to 42 percent for a 30 kt vessel (an increase of 90 percent over the baseline), and from 22 percent to 45 percent for a 50 kt vessel (an increase of 104 percent over the baseline).
- At 10× the base cutter sensor range, the patrol vessel can essentially detect all targets within the patrol area. Hence, intercept speed becomes even more of a factor affecting the percentage of targets boarded. The percentage of targets boarded increased from 22 percent to 53 percent for a 20 kt vessel (an increase of 140 percent over the baseline), from 22 percent to 70 percent for a 30 kt vessel (an increase of 218 percent over the baseline), and from 22 percent to 79 percent for a 50 kt vessel (an increase of 260 percent over the baseline).

Cutter Sensor Range Study Results (High-speed Targets):

- Vessel speed has a more significant impact on percent boardings as detection range increases. The high-speed targets are faster than both the 20 kt and 30 kt vessels; therefore, 50 kt vessels can intercept more high-speed targets. The percentage of high-speed targets intercepted by the slower 20 and 30 kt vessels was based solely on being in a positive initial detection position with a non-evasive target.

- By doubling the base cutter sensor range, a 50 kt vessel doubles target boardings from 9 percent to 18 percent, a 30 kt vessel increases boardings from 7 percent to 12 percent (a 71 percent increase over the baseline value) and a 20 kt vessel increases boardings from 5 percent to 8 percent which is a 60 percent increase over the baseline value.
- At 10× base sensor range, a 50 kt vessel increases boardings from 9 percent to 49 percent which represents an increase of 450 percent over the baseline value, a 30 kt vessel increases boardings from 7 percent to 36 percent which is a 414 percent increase over the baseline value and a 20 kt vessel increases boardings from 5 percent to 30 percent which is a 500 percent increase over the baseline value.

Cutter Sensor Range Follow-on Study

Physical constraints such as horizon limits and the physics of sensor technology make it unrealistic to expect a 10× increase in shipboard sensor range anytime soon. However, the CG is increasing its emphasis on improving MDA. Detection capabilities within patrol areas, an important element of MDA, can be improved dramatically through off-board sensors. Off-board sensors on fixed-wing aircraft, long-range UAVs, and satellite coverage can (and do) provide a significant amount of detection capability. Since improved and increased off-board detection capabilities are more realistic than a 10× shipboard sensor, the next study investigated the impact of intercept speed with increasing off-board sensor coverage.

Off-board Sensor Study

The off-board sensor study investigated the impacts cutter speed had on targets boarded based on detections from off-board sensors. In the controlled modeling environment, off-board sensors were assumed to detect targets in the entire patrol area; however, the amount of time the off-board sensors were available was varied from 10 percent per day to 100 percent per day (i.e., 2.4 hours of total area coverage per day to 24 hours of total area coverage per day) for the entire patrol period. Cutter intercept speeds varied between 20 kts, 30 kts, and 50 kts. Two surface deployable assets, RHIBs, were used in all modeling runs. Figure 10 illustrates the impact of off board sensors coverage and cutter intercept speed on boarding rates achieved during the modeling runs. These results are discussed below.

Off-board Sensor Study Results (Low Speed Targets):

- For low-speed targets, the percentage of boardings is dramatically improved with just 10 percent off-board sensor coverage. Since the target vessels are operating at low speeds, they are in the patrol area for a longer period of time. In this scenario even a limited period of complete sensor coverage permits higher speed vessels to effect more boardings.
- With the patrol area covered 10 percent of the time, the percentage of targets boarded increased from 22 percent to 42 percent for a 20 kt vessel (an increase of 91 percent over the baseline), from 22 percent to 60 percent for a 30 kt vessel (an increase of 173 percent over the baseline), and from 22 percent to 70 percent for a 50 kt vessel (an increase of 254 percent over the baseline).
- Increasing off-board sensor coverage time from 10 percent to 80 percent had only a small impact on low speed target boarding rates.

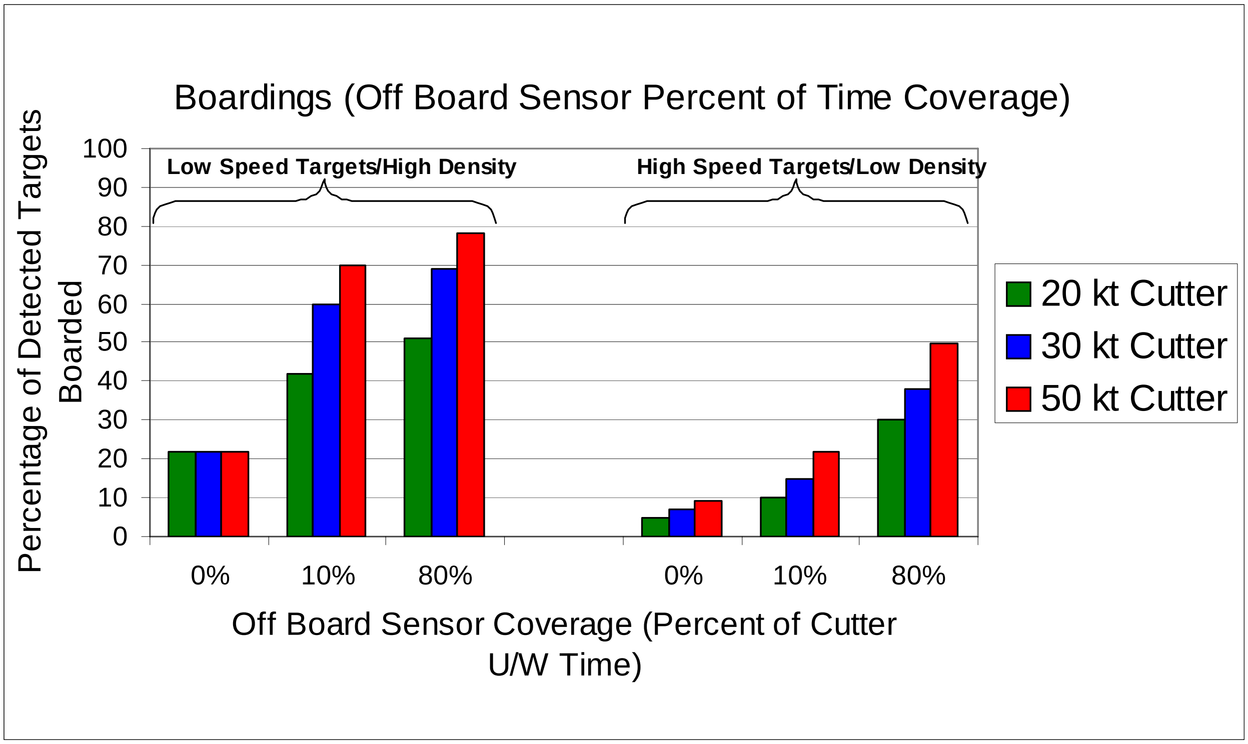

Figure 10. Cutter speed and off board sensor percent of time coverage verses targets boarded findings.

<u>Off-board Sensor Study Results (High-speed Targets):</u>

- For high-speed targets, the percentage of boardings gradually improves with increased sensor coverage time. At around 80 percent coverage time, improvement in boardings due to intercept speed levels off. Unlike low-speed targets, high-speed targets have far less exposure time in the patrol area; therefore, off-board sensors must be available a greater percentage of the time.
- With the patrol area covered 80 percent of the time, the percentage of targets boarded increased from 5 percent to 30 percent for a 20 kt vessel (an increase of 500 percent over the baseline), from 7 percent to 38 percent for a 30 kt vessel (an increase of 442 percent over the baseline), and from 9 percent to 50 percent for a 50 kt vessel (an increase of 455 percent over the baseline).

<u>Off-board Sensor Follow-on Study</u>

The cutter sensor range and off-board sensor studies illustrated that with improved detection capabilities, a 50 kt vessel provides a significant improvement in boardings of both high- and low-speed targets compared to a 30 kt vessel. The next phase of engagement modeling analysis focused on the effects of varying the number and type of deployable assets to execute the boardings. These assets include combinations of 11 m OTH RHIBs and HH-60 helicopters. To help isolate the impact of deployable assets, only 50 kt and 30 kt patrol vessels were evaluated in the multiple deployable assets study.

Multiple Deployable Assets Study

The multiple deployable assets study analyzed the impact of using two, three, or four deployable assets (tethered and untethered).

- Tethered deployable assets are only allowed to affect boardings within 2 hours of the patrol cutter (at the patrol vessel's maximum speed).
- Untethered deployable assets affect boardings within two hours of the patrol cutter at the deployable asset's speed (30 kts for an 11 m OTH RHIB and 150 kts for an HH-60).

The deployable asset configurations were:

- Two deployable assets: two 11 m OTH RHIBs
- Three deployable assets: two 11 m OTH RHIBs and one HH-60
- Four deployable assets: two 11 m OTH RHIBs and two HH-60s

The HH-60s used vertical insertion to transfer boarding teams to the target vessels. Cutter intercept speed was fixed at 30 kts or 50 kts.

This study assumes that cutter sensor range was fixed at 10x base range.

Figure 11 illustrates the impact of number and type of deployable assets, incorporated with cutter intercept speed, on boarding rates achieved during the modeling runs. These results are discussed below.

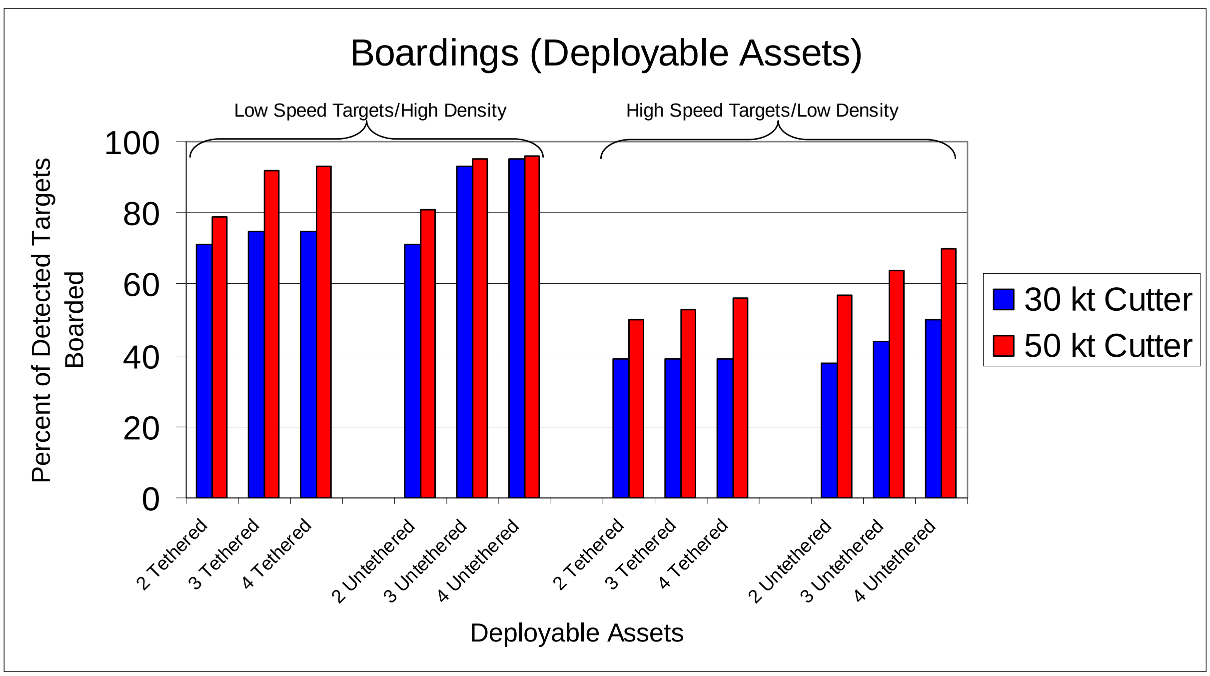

Figure 11. Cutter speed and deployable assets (tethered and untethered) verses targets boarded findings.

Multiple Deployable Assets Study Results (Low Speed Targets):

- With three or four untethered assets, a 30 kt cutter and a 50 kt cutter can execute virtually the same percentage of boardings. In these scenarios, the addition of untethered HH-60 helicopters (boarding range of 300 nm) is the performance driver.
- Compared to a 30 kt cutter, a 50 kt with tethered deployable assets increases the percentage of boardings from 70 percent to 78 percent with two deployable assets and from 74 percent to 93 percent with three or four deployable assets.
- A 30 kt cutter with tethered deployable assets does not gain a significant advantage by increasing the number of deployable assets beyond two, since the assets can only board within two hours of the patrol vessel (or 60 nm for a 30 kt patrol cutter).
- The addition of a fourth deployable asset (a second HH-60) does not improve boarding performance for either cutter speed.

Multiple Deployable Assets Study Results (High-speed Targets):

- With tethered deployable assets, a 50 kt cutter compared to a 30 kt patrol cutter increases the percentage of boardings from 40 percent to 53 percent with two deployable assets and from 40 percent to 57 percent with three or four deployable assets.
- Compared to a baseline 30 kt cutter with two untethered deployable assets, a 50 kt cutter with four untethered deployable assets can nearly double boarding percentage from 37 percent to 67 percent.
- Increasing the number of tethered assets had minimal impact on boarding rates at either cutter speed.
- Increasing the number of untethered assets at either cutter speed provides small, incremental improvements in boarding rates.
- A 50 kt cutter has a consistent advantage over a 30 kt cutter in all modeled deployable asset configurations.

3. HUMAN SYSTEMS INTEGRATION MODELING

Objectives and Approach

The HSI modeling was conducted using the total crew model (TCM). The TCM is a dynamic simulation architecture built using the task-network modeling tool, Micro Saint, which was developed to simulate shipboard manning requirements for naval surface vessels. The development of crew schedules and watch, quarters, and station bill (WQ&SB) assignments in a static fashion often left gaps or inconsistencies that were not easy to uncover, but would reveal themselves in a dynamic environment. Therefore, the TCM was developed to look at manning demands from a dynamic perspective to determine the adequacy of a proposed crew complement. In order to do this, the simulation considers the combined effects of crew complement, daily schedules, WQ&SB assignments, and specific manning requirements for special evolutions and other crew activities. These input data are integrated dynamically over the course of a designed reference mission scenario to assess the adequacy of the proposed manning structure in performing the scenario. A detailed description of the TCM, along with detailed HSI modeling results, is contained in Appendix C.

ONR determined that a crew of 26 personnel could operate Sea Fighter. The vessel seldom achieved its planned OT&E schedule due to cutter system malfunctions, thus the crew size was not fully tested in an operational environment. HSI modeling was used to determine the capabilities of a 26-person crew and the crew structure (size and ratings) needed to sustain the operations of a typical WHEC / NSC patrol.

The WHEC / NSC patrol profile provided for 14 continuous underway days, a mid-patrol in-port replenishment break, followed by another 14 continuous underway days. A 14-day patrol profile was used, since this is the longest continuous underway period. The profile provided for manned and unmanned flight operations in the patrol area for 18 hours per day and an average of three target vessel boardings per day.

The first HSI study entailed applying the 26-person crew against the 14-day patrol profile. Underway operations (e.g., flight operations, boardings) were systematically eliminated from the patrol profile to determine the operations tempo (OPTEMPO) the crew could achieve within acceptable fatigue limits for safe operations. A second HSI study entailed building an optimal crew augmented with detachments that could sustain the 14-day patrol profile and remain within acceptable fatigue limits for safe operations. In both studies, an all-Coast Guard crew was used for analysis, as opposed to the current combined Coast Guard and Navy crew.

Study Findings

Current Crew Structure

Table 2 shows the assignment to condition-3 watches, the assignments to positions for each of the major evolutions modeled, and the manning requirements for each evolution. The major details of the structure of the current 26-person crew are detailed in Table 3. The manning requirements list the positions and numbers required to perform each of the major evolutions included in the TCM. These positions are filled by the billets assigned in Table 3. Note that

there are often more billets listed for a given position than are required in Table 2. For example, during helo flight quarters, one HCO is required but two are identified. The billets identified as HCOs are in essence a resource pool for this position. The model uses a priority or “Trump” matrix in conjunction with task priority weights to identify the most appropriate individual(s) from the pool to fill that position at that time.

Table 2. Summary of major evolution manning requirements (26-person crew).

Helo Flight Quarters	VUAV Flight Quarters	Boat Launch	Boarding
Command (1) HCO (1) LSE (1) Hot Suit (2) Chock & Chain (2) Boat Deck Crane (1) Boat Deck OIC (1) Boat Engineer (1) Coxswain (1)	Command (1) HCO (1) LSE (1) Chock & Chain (2) CIC (1)	Boat Deck Safety (1) Boat Deck Crane (1)	Command (1) Boat Engineer (1) Coxswain (1) Boarding Team (4)

Table 3. Summary of billet assignment to condition-3 watches and major evolutions (26-person crew).

Billet	Cond.-3 Watch	Helo Flight Quarters	VUAV Flight Quarters	Boat Launch	Boarding
C101 – LCDR		Command	Command		Command
C102 – LT		Coxswain	Command		Coxswain
C103 – LTJG	OOD				Boarding Team 1
C104 – LT JG	OOD	Boat Deck OIC		Boat Deck Safety	
C105 – CWO3					Boarding Team 2
C106 – CWO2	NOW	Boat Deck OIC	CIC		
E101 – MKC	EOW	LSE	LSE	Boat Deck Crane	
E102 – MK1	EOW	Boat Engineer			Boat Engineer
E103 – MK1		Boat Engineer			Boarding Team 1
E104 – MK1	EOW	Boat Engineer			Boat Engineer
E105 – MK2		Boat Engineer			Boat Engineer
E106 – EM1	EOW	Boat Engineer			Boat Engineer
E107 – MK2		Chock & Chain	Chock & Chain		
E108 – MK3		Boat Engineer			Boarding Team 2
O101 – ETC	OOD	HCO	HCO	Boat Deck Crane	
O102 – FS1					
O103 – QM1	NOW				Boarding Team 2
O104 – HS1	COMMS	HCO	HCO		
T102 – ITC	NOW		CIC		
T103 – ET1	NOW	Hot Suit			
T104 – IT2	COMMS	Hot Suit			Boarding Team 2
T105 – OS3	COMMS	Chock & Chain	Chock & Chain		Boarding Team 1
W101 – BMC		LSE	LSE	Boat Deck Safety	
W102 – BM1	OOD	Coxswain			Coxswain
W103 – GM2		Boat Deck Crane			Boarding Team 1
W108 – BM2	COMMS	Boat Deck Crane	Chock & Chain		Coxswain

The crew structure detailed above was run against a 14-day patrol scenario with the following characteristics:

- Average three two-hour boardings a day, with several instances of two simultaneous boardings
- Two two-hour manned helicopter flight operations a day
- Three four-hour VUAV flight operations a day

- One all-hands drill performed daily
- Four Condition-3 watch stations—Officer of the Deck (OOD), Engineer of the Watch (EOW), Navigator of the Watch (NOW), Communications (COMMS) Watch—continuously manned in a 1 in 4 rotation

The scenario run in the model included three additional days after the 14-day patrol in order to assess fatigue recovery times. These days are reflected in the model outputs.

Current Crew Results

When the current 26-person crew was run against the scenario described above, several issues were found:

- The crewing made it unfeasible to man the flight deck for helo flight quarters while simultaneously launching a RHIB for a boarding and keeping all condition-3 watches manned.
- Helo flight operations were causing excessive fatigue for many members of the crew, as shown in the Figure 12 for the engineering department. In the fatigue chart, areas under the curves in excess of 6 are considered excessive fatigue (cannot be sustained for more than a day), and areas below 6 are considered acceptable. Areas above 10 are considered dangerously excessive fatigue (microsleeps and attention lapses are frequent) and cannot be sustained even for a day.
- The crew could not perform two simultaneous boardings with the initial six-man boarding teams.

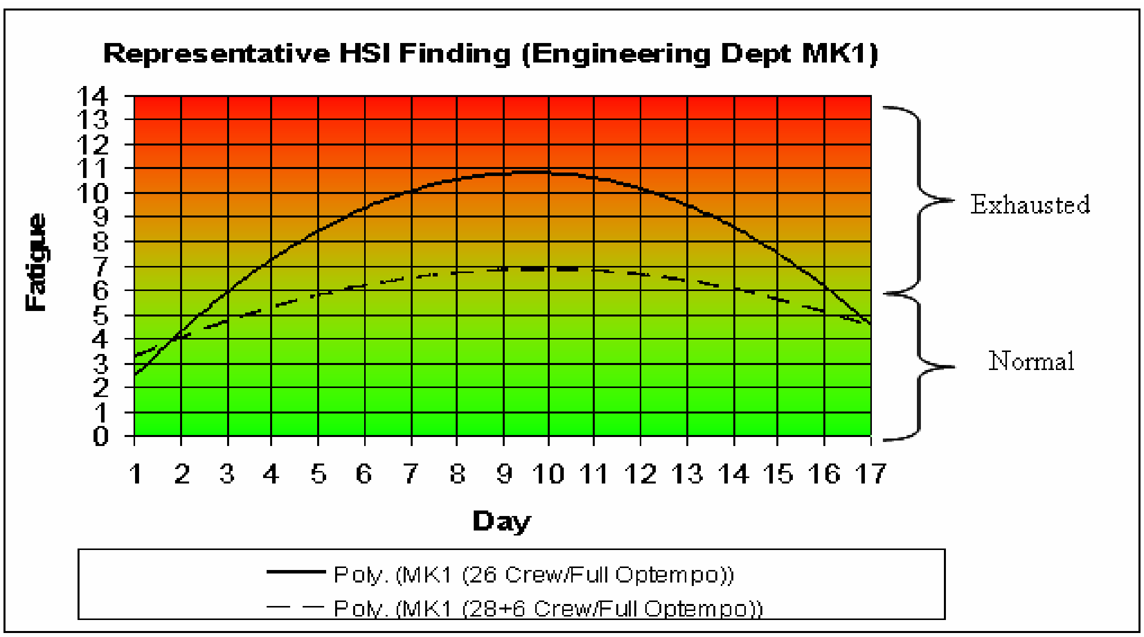

Figure 12. Graphical representation of Human Systems Modeling results.

Based on these results, it was determined that the 26-person crew was unable to run helo flight operations in conjunction with any boarding activities. In addition, in order to run two simultaneous boardings, the boarding teams would have to be reduced to four-man teams.

The 26-person crew was then run against a modified scenario, with the helo flight operations removed and with four-man boarding teams. This resulted in a significant reduction in crew fatigue to acceptable levels. In addition, the crew was able to perform all remaining evolutions, including all boardings and VUAV flight operations successfully while keeping Condition-3 watches continuously manned.

In summary, the current 26-person crew is able to successfully sustain a rather high OPTEMPO that includes an average of three boardings a day with instances of two simultaneous boardings (with four-man boarding teams) and VUAV flight operations. However, this current crew is unable to perform helo flight operations within this OPTEMPO.

Optimal Crew Structure

Building on lessons learned from the analysis of the current 26-person crew, an effort was made to define a new crew structure that could sustain the desired OPTEMPO as detailed in the original scenario. The new crew makeup should not only be able to perform helo flight operations, but also to run six-man boarding teams. In addition, the optimal crew structure should be as small as possible while not inducing excessive fatigue.

The original 26-person crew was determined to be quite efficient with a few exceptions, namely helo flight operations and simultaneous boardings. Therefore, the revisions to the crew size specifically addressed these deficiencies. The result was the addition of two boatswain mates (BM1, BM2). These two additional crewmembers resolved the flight ops/ boarding issues. In addition, a six-person law enforcement detachment was added to create the primary boarding team. Within the new 28+6 crew structure, two boarding teams are used, one organic and one from the detachment, and each consists of five boarding team members plus a boarding officer.

The manning requirements for each evolution are detailed in
Table 4. The major details of the structure of the new optimized 28+6 crew are detailed in Table 5.

Table 4. Summary of major evolution manning requirements (optimal crew).

Helo Flight Quarters	VUAV Flight Quarters	Boat Launch	Boarding
Command (1) HCO (1) LSE (1) Hot Suit (2) Chock & Chain (2) Boat Deck Crane (1) Boat Deck OIC (1) Boat Engineer (1) Coxswain (1)	Command (1) HCO (1) LSE (1) Chock & Chain (2) CIC (1)	Boat Deck Safety (1) Boat Deck Crane (1)	Command (1) Boat Engineer (1) Coxswain (1) Boarding Officer (1) Boarding Team (5)

Table 5. Summary of billet assignment to condition-3 watches and major evolutions (optimal crew).

Billet	Cond.-3 Watch	Helo Flight Quarters	VUAV Flight Quarters	Boat Launch	Boarding
C101 – LCDR		Command	Command		Command
C102 – LT		Coxswain	Command		Coxswain
C103 – LTJG	OOD				Boarding Officer
C104 – LT JG	OOD	Boat Deck OIC		Boat Deck Safety	
C105 – CWO3					Boarding Officer
C106 – CWO2	NOW	Boat Deck OIC	CIC		
E101 – MKC	EOW	LSE	LSE		
E102 – MK1	EOW	Boat Engineer			Boat Engineer
E103 – MK1		Boat Engineer			Boarding Team 2
E104 – MK1	EOW	Boat Engineer			Boat Engineer
E105 – MK2		Boat Engineer			Boat Engineer
E106 – EM1	EOW	Boat Engineer			Boat Engineer
E107 – MK2		Chock & Chain	Chock & Chain		
E108 – MK3		Boat Engineer			Boarding Team 2
O101 – ETC	OOD	HCO	HCO	Boat Deck Crane	
O102 – FS1					
O103 – QM1	NOW				Boarding Team 2
O104 – HS1	COMMS	HCO	HCO		
T102 – ITC	NOW		CIC		Boarding Team 2
T103 – ET1	NOW	Hot Suit			
T104 – IT2	COMMS	Hot Suit			
T105 – OS3	COMMS	Chock & Chain	Chock & Chain		
W101 – BMC		LSE	LSE	Boat Deck Safety	
W102 – BM1	OOD	Coxswain			Coxswain
W103 – GM2		Boat Deck Crane			Boarding Team 2
W108 – BM2	COMMS	Boat Deck Crane	Chock & Chain	Boat Deck Crane	
BM1		Coxswain			Coxswain
BM2		Boat Deck Crane	Chock & Chain	Boat Deck Crane	
Det – LEDet1					Boarding Officer
Det – LEDet2					Boarding Team 1
Det – LEDet3					Boarding Team 1
Det – LEDet4					Boarding Team 1
Det – LEDet5					Boarding Team 1
Det – LEDet6					Boarding Team 1

Optimal Crew Results

The scenario used as the criterion for the optimal crew was largely the same as the original scenario for the 26-person crew with one exception. The flight operations schedule was modified in order to reduce fatigue. It was found that the original schedule, where the first and last flight operations of the day were both helo ops, tended to substantially increase fatigue. Therefore, the flight operations were rearranged with the VUAV performing the early and late flight operations. This new flight operations schedule was not rerun with the 26-person crew, since that crew was unable to perform the full flight operations schedule without exceeding severe fatigue thresholds. The new scenario which substituted in VUAV flights would not have improved the fatigue issues.

When the optimized 28+6 crew was run against the scenario described above, they were able to successfully execute all evolutions while continuously manning all Condition-3 watches. In addition, fatigue levels across the crew were acceptable, as shown in the Table 5 for the engineering department.

In summary, the optimized 28+6 man crew is able to successfully sustain the required OPTEMPO that includes an average of three boardings a day with instances of two simultaneous boardings and all VUAV and helo flight operations. It also appears that from a fatigue standpoint, this OPTEMPO could be sustained indefinitely.

4. CREW INSIGHTS

Objectives and Approach

Sea Fighter's CG and Navy crew combined have more than 200 years of seagoing experience. They transformed an experimental vessel into a fully operational vessel during the 13 months they were on-board. They have the most comprehensive knowledge of the vessel, and given their seagoing experience, they offer invaluable insight into Sea Fighter's capabilities (good and bad) relative to traditional CG and Navy ships. It was critical that the overall evaluation of Sea Fighter capture the wealth of knowledge gained by the cutter's crew. In addition, the valuable insights of air station and specialty team (MSST) personnel that operated on Sea Fighter was also captured and incorporated.

The design capabilities of new vessels are often different from the actual capabilities of the vessel as witnessed by those who sail on-board. Since Sea Fighter is an experimental vessel, the combined CG/USN crew afforded an opportunity to obtain firsthand information on the vessel's unique capabilities. Crew and shipriders' (R&DC representatives and CG MSST personnel and helicopter pilots) insights are used to complement the information gained from OT&E and M&S activities.

Summary insights focus on crew and shiprider observations relative to the unique capabilities of Sea Fighter: *High-speed, Multiple Deployable Assets, Small Crew Size,* and mission payload *Modularity*. Additional insights are provided in Appendix D.

Summary Insights

Summary insights are based on a consensus of written surveys completed by the crew, face-to-face interviews of the crew, and shipriders' observations.

High-speed

<u>50 kts</u>

Sea Fighter accelerated to 50 kts in less than five minutes and was highly maneuverable at top speed; it could turn tightly and stops in a very short distance. The crew believed high-speed capability would be a great asset in accomplishing any law enforcement mission and especially effective at intercepting fast, evasive, and uncooperative targets.

<u>Ride Quality</u>

Ride quality was better at higher speeds than at lower speeds in both low- and high-period waves, independent of wave height (sea state). At high speeds, the vessel skimmed over the tops of low-period waves and followed the surface of long-period waves. In medium-period waves, high-speed ride quality was degraded due to wave slamming on the wet deck. Wave slamming could usually be mitigated by course and speed changes.

At speeds below 15 kts, ride quality degraded. Vessel roll, pitch, and heave increased, with "jerky" motions rather than "slow" motions typically associated with a monohull. The ride control system (T-foils, active skegs, and interceptor control surfaces) did not have a significant impact on dampening roll, pitch, and heave below 15 kts, probably due to the reduced flow over those control surfaces. Vessel motions at low speeds (5 kts) often adversely affected the launch and recovery of deployable surface assets RHIBs.

Noise Levels

The vessel was noisy at high-speeds due to a combination of wind on the superstructure and water noise on the hulls and T-foils, in addition to the noise generated by the gas turbines. Little (to no) insulation was installed on the vessel, which would dampen some of the noise. For several crewmembers, the noise resulted in fatigue and headaches. Hearing protection must be worn to prevent hearing damage while in the aft portion of the Mission bay during turbine operations.

Training Weapons on Targets

The Sea Fighter successfully demonstrated the crews' ability to track and train its weapons (small arms) on targets of interest while operating at high-speeds (50 kts). However, apparent wind speed across the flight deck in excess of 80 kts would preclude personnel from manning the weapons on the flight deck. A weapons station can be seen in Figure 13.

Figure 13. Sea Fighter .50 caliber machine gun on port amidship's gun mount.

Multiple Deployable Assets

Surface Deployable Assets

Sea Fighter was outfitted with one 11 m RHIB, which restricts the ability of the ship to conduct multiple boardings. The vessel was capable of carrying up to three 11 m RHIBs or five-plus 7 m RHIBs; however, the X-Y crane in the mission bay cannot be used underway to move the RHIBs onto the stern ramp.

Stern Ramp

The stern ramp was used to launch and recover surface deployable assets. The existing stern ramp was poorly designed with a 17-degree incline as seen in Figure 14. The steep angle required the coxswain in the 11 m RHIB to use full throttle upon entering the ramp. This was both unsafe for the RHIB and put excessive stress on the RHIB's propulsion system (engine and waterjet). A missed approach to the ramp could result in the RHIB being trapped under Sea Fighter's waterjet guards. Sea Fighter's RHIB launch and recovery speed was limited to 5 kts, due to safety interlock positioning defaults on the waterjets (all four water jets were pitched full out). At speeds less than 5 kts, Sea Fighter's ride quality is degraded, resulting in increased roll, pitch, and heave, which adversely affects the launch and recovery of the RHIB.

Figure 14. 7 m RHIB on Sea Fighter stern ramp pier side.

SOLAS Boat

Another deployable asset, the Safety of Life at Sea (SOLAS) boat was designed to be used for man overboard recovery operations. The launch and recovery equipment was poorly designed, resulting in an awkward and potentially dangerous operation. When the SOLAS boat was swung out and lowered, it rotates excessively (even with bow and stern tending lines). An image of the boat being boomed out over the water jets can be seen in Figure 15. Once the boat was in the water, there was a concern that it could be caught under the flare of Sea Fighter's hull. Based on safety concerns, man overboard recovery was performed by the 11 m RHIB via the stern ramp.

Figure 15. SOLAS boat launch from Sea Fighter off San Diego.

Air Deployable Assets

Sea Fighter could accommodate two manned helicopters on deck simultaneously (including HH-60s), two-plus VUAVs, or a combination of manned and unmanned aircraft. There is currently no hangar on Sea Fighter; however, there is an elevator from the flight deck to the Mission bay. The elevator can accommodate helicopter parts or VUAVs similar to the Eagle Eye (or smaller). If Sea Fighter operates at high-speeds with helicopters on deck, rotor blade boots must be applied to prevent blade rotation.

Flight Deck Operations

The flight deck size easily accommodated two HH-65Cs for simultaneous flight operations during OT&E scenarios. The flight deck, seen in Figure 16, was significantly better than most Coast Guard flight decks due to "clean air" across the flight deck (reduced eddies caused by ship superstructures), excellent visibility of the forward horizon, and an outstanding flight deck lighting system for night operations.

Sea Fighter does not have a hangar to protect an embarked helicopter from salt spray; however, it does have a high-capacity freshwater washdown capability. The aviation gasoline (AVGAS) refueling station was conveniently located on the flight deck. The helicopter support kit (HSK) can easily be stored in the mission bay, and the elevator can be used to transport maintenance equipment between the mission bay and flight deck.

The capability to operate two HH-60s simultaneously permits an entire MSRT or MSST (16 people) to rapidly board a target of interest.

Figure 16. Sea Fighter’s flight deck as seen from HH-65C during flight operation off Los Angeles.

Crew Size

Too Small

A 26-person crew size was adequate for standing underway watches but significantly limits sustained underway operations such as flight operations and boardings via surface deployable assets. The crew felt the Sea Fighter was undermanned, and the crew composition and cross-training adversely impact flexibility. Crew fatigue is discussed in Section 3.

Automation Helps

The Sperry integrated bridge and navigation system (IBNS) provided the OOD and NOW with excellent situational awareness and full control over multifunction display consoles from a seated or standing position. This significantly reduced the number of underway watchstanders on the bridge and provides the OOD hands-on control of vessel operations. Figure 17 shows the OOD in front of his control station. The OOD was standing at his position in front of and to the right of his chair. The NOW is located to the OOD’s far left. The Commanding Officer is in the middle seat.

Figure 17. Sea Fighter bridge watch team (with CO) at integrated bridge console underway.

The installed aqueous film forming foam (AFFF) total flooding system on the flight deck facilitated a minimal flight deck crew of six persons (two chock-and-chain men, three hot suit men, and one landing signal enlisted (LSE)).

The machinery spaces on Sea Fighter were unmanned. The machinery control system (MCS-5) permited the EOW to control and monitor the main propulsion engines and all auxiliary machinery from the engineer's watchstation on the bridge. Most EOWs remarked favorably about the MCS-5 system's design and recommended it for future ships. An engineering rover made routine rounds of machinery spaces. An alternative to further reduce the number of underway watchstanders was to allow the EOW to make routine rounds (as opposed to using the Rover for routine rounds). The OOD has duplicate control of all EOW console functions at his console.

Modularity

Mission Payload Flexibility

Sea Fighter has a large reconfigurable mission bay that was capable of accommodating up to 12 ISO Containers (see Figure 18), multiple surface and air deployable assets, or large numbers of detainees (400+) in the middle and forward portion of the space.

Figure 18. ISO container in Sea Fighter mission bay.

Deployable Teams

Modularity could have permitted the MSRT or MSST to deploy with its entire pre-outfitted modules, and to use the mission bay for pre-staging/pre-briefs before the boardings. The wide passageways and ladders and the elevator would have enabled the MSRTs and MSSTs to move easily about the ship with full gear.

Mission Bay Operations

Underway the mission bay was excessively noisy, often collected engine exhaust fumes, and stern wash spray. Two isolation doors were installed to divide the mission bay into three sections; however, the doors were often inoperative. The climate-controlled forward section accommodated mission modules and the elevator to the flight deck. It was an excellent location for specialty teams to lay out equipment and prep for boardings. The midsection was ventilated and provides an outstanding containment area for holding detainees. The aft section was not ventilated and provided open access to the stern, the SOLAS boat, the deployable surface asset stern ramp, an area to prep additional deployable surface assets, and exterior access to the flight deck.

There was an overhead crane (the X-Y crane) in the mission bay that is used to move mission modules. The X-Y crane was vital to mission bay operations. However, it was not designed for shipboard use and cannot be used underway, which potentially could inhibit mission operations. Without this capability, Sea Fighter was only able to launch and recover one 11 m RHIB (or 7 m RHIB).

The elevator from the flight deck to the mission bay was not flush with the deck of the mission bay when fully lowered. The elevator platform was approximately 1.5 feet above the mission bay deck, which made it very difficult to move heavy material on and off the elevator platform.

5. CONCLUSIONS

A Sea Fighter-like cutter (i.e., ModCAT hullform) offers superior High Endurance Cutter (WHEC) mission capabilities with the crew size and performance characteristics of a patrol boat.

The ModCAT hullform provides excellent flexibility for Coast Guard missions currently performed by a patrol boat or a WHEC. As a patrol boat, the vessel can operate for 14 continuous underway days, execute an average of three boardings per day, intercept targets at 50 kts, and conduct VUAV flight operations with just a 26-person crew. As a WHEC, the vessel can operate 14 continuous underway days, execute an average of three boardings per day, intercept targets at 50 kts, and conduct both helicopter and VUAV flight operations with a crew of 28 plus a 6-person boarding detachment (LEDET, MSST, MSRT).

The mission payload capacity of Sea Fighter could provide the Coast Guard tremendous mission flexibility. Multiple deployable teams (MSRTs, MSSTs) with modularized mission packages can deploy for extended periods. Secure and environmentally controlled detainment capability provides for surge AMIO operations. The large Mission bay can readily accommodate up to 12 C4ISR and/or habitability modules to perform extended on-scene command and control. Sea Fighter is not weight critical with respect to stability and has ample top side area to install any required antennas or sensors. The two-pad flight deck permits simultaneous flight operations for two manned helicopters, multiple VUAVs, or a combination of both.

The conclusions from the four main Sea Fighter capabilities can be summarized as follows:

- High-speed (50 kts) capability would prove useful in areas where high-speed targets are the major concern, or in a situation where rapid response (transit) is a priority such as natural disasters. This speed advantage becomes especially effective when combined with wide-area, off-board sensing capability.
- The ability to operate multiple deployable assets (greater than 2) appears to be the most vital capability that Sea Fighter possesses. Both OT&E and M&S demonstrated that the abilities to execute multiple boardings and assist in target detection is of the utmost importance (regardless of intercept speed). The addition of untethered HH-60 helicopters (boarding range of 300 nm) was the performance driver in the M&S scenarios.
- The tradeoff of a small crew size for automation can be achieved for pure vessel operation. Augmentation of the ship’s core crew prior to periods of high OPTEMPO is a necessity.
- Modularity (while not fully evaluated) proved to be one of the more useful capabilities of Sea Fighter in that crew augmentation units and other ship riders could easily be accommodated. Additionally, modular ship design provides the ability to support multiple deployed assets (i.e., UAVs/USVs/USSVs) and conduct other missions with minimal operational interruption.

A highly automated Sea Fighter-like cutter provides more mission capability, albeit for a shorter duration, than a WHEC with the crew size of a patrol boat. The ModCAT hullform and large mission bay provides excellent flexibility for emerging Coast Guard missions and demands. Its speed and multiple deployable asset capability offer outstanding performance improvement potential for the Coast Guard; however, a critical enabler is improving awareness of vessel traffic

within the oparea – an element of maritime domain awareness. As MDA improves, a 50 kt patrol cutter capable of deploying four deployable assets (i.e. helos, RHIBs, UAVs) could provide a tremendous improvement in end-game capability over current and future 30 kt cutters.

6. RECOMMENDATIONS

The CG needs to continue to evaluate non-standard hull forms such as ModCAT-type vessels for both speed and modularity purposes. High-speed vessels normally have endurance problems based on their fuel consumption rates. This has been one of the perceived shortcomings of this hullform type. However, the ModCAT hullform (i.e. Sea Fighter) provides very good fuel economy and, given the typical patrol profile (12 kt patrol speed, 20 kt transit speed, and 50 kt intercept speed), the vessel is capable of remaining within the patrol area for an entire patrol period. Opportunities exist for the CG to further evaluate other Navy/DOD high-speed vessels (HSV) such as the M88 Stiletto for MSRT type missions and the HSV platforms, HSV Swift and HSV Joint Venture, for extended duration missions.

Additionally, the CG should look at ways to optimize the number and type of deployable and off-board assets through a more detailed M&S analysis. A 50 kt Sea Fighter-like cutter with four deployable assets (e.g., two 11 m OTH RHIBs and two HH-60 helicopters) can provide significant mission performance improvement compared to a standard 30 kt cutter. To maximize the benefit from embarking four deployable assets (two 11 m OTH RHIBs and two HH-60s), a revised approach to boardings would need to be established. Currently, boardings are to be conducted within two hours from the WHEC (at the WHEC's maximum speed). Under the MSRT CONOPs, the boarding teams would need to be trained similar to MSRTs which are able to defend themselves while conducting a boarding at greater distances from the patrol vessel.

The CG needs to continue to incorporate more automated systems on-board cutters, but have contingency plans (both personnel and equipment) in place for changes in operational requirements or causalities. In order to derive optimal mission effectiveness, the patrol cutter must be able to safely navigate and operate deployable assets in varying sea states and at a reasonable speed. Sea Fighter's automated systems allow for these evolutions to be conducted with fewer crew members and with an acceptable margin for safety.

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APPENDIX A. GLOSSARY OF TERMS

Glossary of Terms

Term	Definition
Bridge Resource Management	Bridge Resource Management, or Bridge Team Management, is the effective management and utilization of all resources, human and technical, available to the Bridge Team to ensure the safe completion of the vessel's voyage.
Characteristics	Any property or attribute of an item, process, or service that is distinct, describable, and measurable. Features or attributes of the Sea Fighter that define its operational capabilities and that distinguish this vessel from other vessels.
Crew Interviews	Structured crew interviews conducted in April and May 2006 of every crewmember by a team of interviewers in port in San Diego, CA. Follow-up interviews of primarily the Coast Guard crewmembers are scheduled in July 2006 before they are scheduled to depart the Sea Fighter for their next duty station.
Crew Surveys	A crew survey in the form of a written questionnaire was developed by the R&DC and completed by all crewmembers except for the Commanding Officer in January 2006. The questions allowed five different answers, ranging from "Strongly Disagree" to "Strongly Agree." Comments could also be written in for each question.
Experiment Plan	Developed for the Engagement and HSI modeling effort. The Experiment Plan describes the requirements for the development and execution of the models and includes the inputs, outputs, variables, and number of replications that were planned.
Implementation Plan	Developed for the engagement and HSI modeling effort. The Implementation Plan describes the selection of the appropriate model, development of the approach and assumptions, and the validation and verification of the approach to execute the scenario.
Joint Experiment Plan	The Joint Experiment Plan presents the strategy and framework for evaluating the Sea Fighter through coordinated OT&E and M&S. It was developed as a living document with content that evolved over the life of the project. It is available as a companion document to this report (Reference 3)
OASIS Program	The Operations Analysis Simulation Information Support (OASIS) program at the R&DC is designed to serve the needs of all programs at the R&DC for operations analysis and modeling and simulation. The Sea Fighter program at the R&DC is leveraging support through OASIS for their program.
Observations of Operations	Observations of Sea Fighter operations while the ship was conducting dedicated Coast Guard tests and evolutions such as Drug Enforcement operations, Maritime Domain Awareness Exercises, Alien Migrant Interdiction Operations, and main space fire drill. During this period the Sea Fighter conducted day and night helicopter operations, including vertical insertion of a Marine Safety and Security Team (MSST) on-board Sea Fighter and landing two HH-65 helicopters simultaneously on the Sea Fighter's flight deck. Telephone interviews of the helicopter pilots and senior members of the MSST were conducted and included in these observations.
OT&E Test Plan	Provides the details and schedule for conducting Operational Test and Evaluation (OT&E) on the Sea Fighter. This Plan focused on the tests and trials that would be conducted during the underway periods dedicated to Coast Guard testing and provided the Measures of Effectiveness for each test.
Scenario	Scenarios provide the operational description of the supported mission and the measures of system effectiveness, defines the data or assumptions to be used in the modeling, and identifies data requirements that may be provided from the OT&E efforts.
Sea Fighter Development Team	The Development Team comprises representatives from the R&DC as well as members of the OASIS Support Team that are directly supporting the Sea Fighter Analysis Support Project.

Term	Definition
Stakeholders	The stakeholders consist of representatives from the Coast Guard, the U.S. Navy, and shipbuilders who are involved in the future of the Sea Fighter.
Steering Committee	The Steering Committee comprises key stakeholders from selected organizational elements in the Coast Guard, U.S. Navy, and Sea Fighter.

APPENDIX B. ENGAGEMENT MODELING

This appendix is published separately on a CD-ROM due to the volume of the appendix.

APPENDIX B. ENGAGEMENT MODELING

B.1 Objectives and Approach

The objective was to determine the impact of *high speed* and *multiple deployable assets* on Coast Guard mission effectiveness. Engagement modeling was selected as the best means to evaluate *high speed* and *multiple deployable assets* impact on mission effectiveness. OT&E provides a means to verify and validate vessels characteristics, but does not provide a means to evaluate the impact those characteristics have on mission effectiveness.

A comprehensive approach was developed for the engagement modeling plan. Four primary studies were developed to determine the impacts of high speed and multiple deployable assets on mission effectiveness. An immediate detailed review of the outputs from each study by the M&S Team was incorporated into the schedule. Additional “follow-on” studies were incorporated into the overall modeling plan in anticipation of questions from the M&S Team on primary study outputs.

Primary Study 1: Intercept Speed was varied to determine the impact on targets detected and boarded. Detections were solely based on the ships surface search radar. Patrol vessel intercept speeds were selected based on the maximum speeds of legacy cutters (20 kts), planned Deepwater National Security Cutters (30 kts), and Sea Fighter (50 kts).

> **Follow-on Study 1.1: Sea Fighter Sensor Range** varied the ship’s surface search radar by 2× and 10× to expand detection capability.
>
> **Follow-on Study 1.2: VUAV Surveillance** was used to complement the ships’ surface search base radar range.
>
> **Follow-on Study 1.3: Full Patrol Area Detection (i.e., full Maritime Domain Awareness)** investigated the impact of full Maritime Domain Awareness for the patrol area on detections and boardings.

Primary Study 2: Target Vessel Boardings via 2 RHIBs and 1 Helicopter was evaluated to determine the impact on targets boarded based on increasing the boarding capability (via helicopter) than is used on legacy cutters (or planned for the Deepwater cutters).

Primary Study 3: Sea Fighter Fuel Consumption was evaluated to determine if Sea Fighter could remain on station for the entire patrol period without refueling since high speed vessels consume significant amounts of fuel at intercept speed. Early departure from the patrol area would result in reduced coverage and thus reduced mission effectiveness based on targets detected and boarded.

Primary Study 4: Target Vessel Boardings via 2 – 11m RHIBs and 2 – HH60 Helicopters was evaluated since Sea Fighter has greater deployable asset capacity than legacy cutters or planned Deepwater cutters (two+ 11m RHIBs or five+ 7m RHIBs, and two HH60s).

> **Follow-on Study 4.1: Target Vessel Boardings via 2 - 11m RHIBs and 2 – HH60 Helicopters (Untethered)** eliminated the two-hour distance (based on the maximum speed of the intercepting patrol vessel) that a boarding team could operate from the intercepting patrol vessel.

B.2 Engagement Model

The engagement model uses CACI's SIMSCRIPT II.5, a discrete-event simulation language. The model is a discrete-event platform-level model that supports the individual movement of assets and targets within a defined geographical area. Asset sensor capabilities determine the detections, classifications, and identification of targets transiting through the patrol area. The model computes intercept courses at patrol vessel intercept speeds and executes the effects of boardings. Activities are recorded in sufficient detail to process the defined measures of effectiveness for each scenario.

Details regarding the engagement model Experiment and Implementation Plans and Scenarios (including description, patrol vessel concept of operations (CONOPS), inputs, assumptions, variables, and measures of effectiveness) and patrol area (characteristics, patrol vessel profile and behavior, target characteristics and behavior, and deployed assets) are contained in the following sections.

B.2.1 Engagement Model Scenarios

Description: Two mission-like scenarios were developed: high-speed targets/low density and low-speed targets/high density. The high-speed/low-density scenario corresponds to counterdrug, counterterrorism, and a small subset of AMIO missions. This scenario includes legitimate traffic (five vessels/day) transiting at 15 kts and go-fast targets (two or five targets/day) transiting at 35 to 45 kts. The low-speed/high-density scenario corresponds to fisheries and other missions that involve less-evasive targets but in greater numbers. This scenario includes medium and large fishing vessels (five or ten targets/day) transiting at 5 to 15 kts, and there is no legitimate traffic.

Patrol Vessel CONOPS: The patrol vessel conducts a random search pattern within the patrol area at patrol speed. The patrol vessel's surface search radar is used to detect targets of interest. Upon detection of a target, the patrol vessel intercepts the target at intercept speed, classifying and identifying the target vessel when it comes within range. Targets that can be intercepted within the patrol area and within four hours are intercepted and boarded. In the high-speed scenario go-fast targets take precedence for interception and boarding over legitimate traffic by the patrol vessel.

Assumptions: The following assumptions apply to the primary and follow-on studies:

- Deployable surface assets (11m over-the-horizon (OTH) RHIBs and 7m RHIBs) and air assets (VUAVs and helicopters) are used to effect surveillance and/or boardings as described for each primary and follow-on study.
- Unlimited fuel. Although fuel was assumed to be unlimited, fuel consumption was monitored in the model. The fuel consumption rates are shown in Table B-1 in section B.3 (Primary Study 3).
- Calm seas and weather. Therefore, there are no constraints (pitch and roll) on launching and retrieving small boats, VUAVs, or helicopters.
- Sensors were used in daytime configuration only and were not degraded for nighttime

operations.

- Patrol duration is 14 days, including transit time to and from the patrol area.
- Upon intercept, a target will stop and submit to a two-hour boarding.
- Sea Fighter can perform boardings with deployable surface and air assets as described for each primary and follow-on study. Deployable air assets use JP-5 fuel, which is dedicated for use by air assets. It is assumed there is sufficient JP-5 fuel capacity to support all air operations as defined for each primary and follow-on study.

Variables: Variables are defined for each primary and follow-on study/scenario combination and include:

- Patrol vessel intercept speed: 20 kts, 30 kts, 40 kts, and 50 kts
- Legitimate traffic and/or target density: two/day, five/day, ten/day
- Deployable assets: 7m RHIB, 11m OTH RHIB, VUAV, HH-60 helicopter. Quantity/configuration of deployable assets (two, three, or four assets) are defined for each primary and follow-on study. Deployable assets are tethered or untethered as defined for each primary and follow-on study. Tethered deployable assets must conduct boardings within two hours' distance from the patrol vessel at the patrol vessel's maximum speed. Untethered deployable assets may conduct boardings up to two hours' distance from the patrol vessel at the maximum speed of the deployable asset (30 kts for a OTH RHIB and 150 kts for a HH-60 helicopter)..
- Patrol vessel onboard sensor range: base range (18 nm for go-fast targets, 24 nm for large fishing vessels, and 20 nm for medium-size fishing vessels), 2× base range, 10× base range.
- Offboard sensor time coverage: Offboard sensors provide 100% Maritime Domain Awareness of the entire patrol area. The variable is the amount of time during the day (0% through 100% in increments of 10%) the offboard sensor coverage is available. For example, 10% of the day is 2.4 hours.

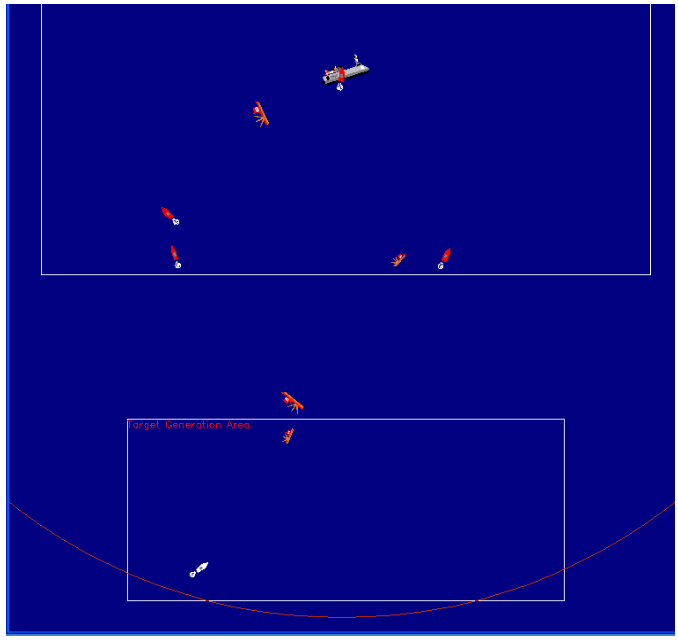
Measures of Effectiveness (MOE): MOEs include the percentage of targets detected, classified, identified, and boarded. The calculation of the measures, delineated by target type, are as follows:

- % targets Detected = Total # detected / Total # of Targets
- % targets Classified = Total # Classified / Total # of Targets
- % targets Identified = Total # Identified / Total # of Targets
- % targets Boarded = Total # Boarded / Total # of Targets

Experiment: The experiment consists of 100 replications of each of the scenarios used in the primary and follow-on studies.

Inputs: Scenario inputs include patrol area characteristics, patrol vessel profile and behavior, and target characteristics and behavior as described in the following sections.

B.2.2 Patrol Area



Characteristics: The geography of the engagement model shown in the figure to the right includes the patrol area and the target generation area set apart from the patrol area in order to disperse targets throughout the patrol area. The patrol area is 350 nm wide and 160 nm deep. The target generation area is 250 nm wide, 100 nm deep, and separated from the patrol area by 80 nm. In the figure, the icon for the patrol vessel is gray, target icons are red, and legitimate traffic icons are white.

Patrol Vessel Profile and Behavior. The total fuel capacity of the patrol vessel is 160,000 gallons. The patrol vessel departs homeport with a full fuel load and transits 200 nm to the patrol area at 20 kts. The patrol vessel patrol speed is 12 kts, and it conducts a random search for targets. If the patrol vessel needs to be refueled before the end of the 14-day patrol, the patrol vessel departs the patrol area with sufficient fuel onboard to transit to homeport at 20 kts and arrive in homeport with at least 10% fuel remaining in reserve.

The patrol vessel is assigned to the patrol area for a period of 14 days. Upon entering the patrol area, the patrol vessel conducts a random search at 12 kts, and upon classification of a target of interest, proceeds at intercept speed to the target interception point within the patrol area. Upon intercept, the patrol vessel launches one of its RHIBs to conduct a two-hour boarding. The patrol vessel is capable of conducting multiple simultaneous boardings with RHIBs and HH-60 helicopters subject to the restriction that all boardings must occur within two hours' distance from the patrol vessel at the patrol vessel's maximum speed.

Target Characteristics and Behavior: High-speed targets are medium-small (40 to 50 foot) go-fast vessels that transit at 35 to 45 kts. Legitimate traffic transits at 15 kts. Low-speed targets include medium (50 to 80 foot) and large (80 to 120 foot) fishing vessels. All targets maintain course and speed and do not attempt to take evasive action.

Deployed Assets: Deployable air assets (HH-60 and VUAV) detection ranges: 24 nm for go-fast targets, 36 nm for the large fishing vessels, and 30 nm for the medium fishing vessels. Maximum speed of surface deployable assets is 30 kts; maximum speed for HH-60s is 150 kts.

B.3 Findings

Aggregate findings are presented below followed by summary findings from the primary and follow-on studies.

Aggregate Findings

A vessel with a maximum speed of 30 kts and two surface deployable assets provides the optimum mission effectiveness *TODAY* based on two very limiting factors: limited Maritime Domain Awareness (MDA) (i.e., inability to detect and identify all targets operating within an area of interest) and the restriction that boardings can only occur within two hours' distance (at maximum patrol vessel's speed) from the intercepting patrol vessel.

As MDA improves the limiting factor for mission effectiveness shifts from MDA to patrol vessel intercept speed. A 50 kt ship will yield a 15% increase in high speed targets boarded over a 30 kt ship based on a detection capability of 100% coverage of a patrol area at least 80% of the time.

With improvements in MDA and patrol vessel capabilities (i.e., intercept speeds of 50 kts and greater than two deployable assets) the two-hour distance restriction will become the limiting factor for mission effectiveness. Eliminating the two-hour distance restriction will produce a 30% increase in targets boarded for a 50 kt vessel compared to a 30 kt vessel.

Primary Study 1: Intercept Speed Findings

Background: Intercept Speed study investigated how intercept speed of a patrol vessel affects the percentage of detections and boardings of targets of interest. Two scenarios were used: high-speed/low-density targets and low-speed/high-density targets. Intercept speeds were varied at 20, 30, 40, and 50 knots to examine the impact on targets detected and targets boarded. The only sensor used for detections was the ship surface radar with a base range of 18nm for high speed targets and 24nm for low speed targets.

Figure B-1 shows the percentage of detections and boardings of high-speed targets as a function of the intercept speed of the patrol vessel.

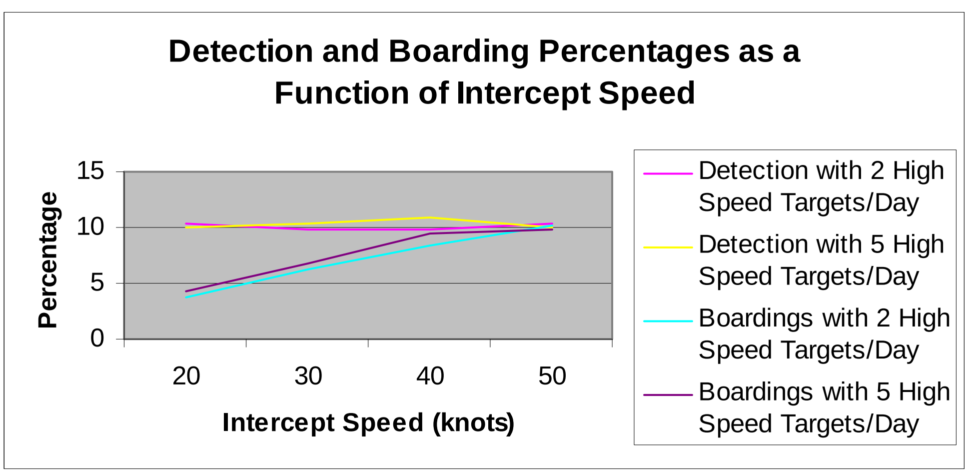


Figure B-1: Detection and Boardings of High-Speed Target

Key Points:

- Only 10% of the high-speed targets are detected due to limited detection capability of the ship's surface search radar (with a range of 18nm).
- At the highest intercept speed (50 kts), all targets detected are intercepted.
- At the lowest speed (20 kts), only about half of the targets detected are intercepted.
- Since the percentage detected is so small, the absolute difference is not that great.
- The density of high-speed targets (two per day vs. five per day) does not make a significant difference.

Figure B-2 shows the percentage of detections and boardings of low-speed targets as a function of the intercept speed of the patrol vessel.

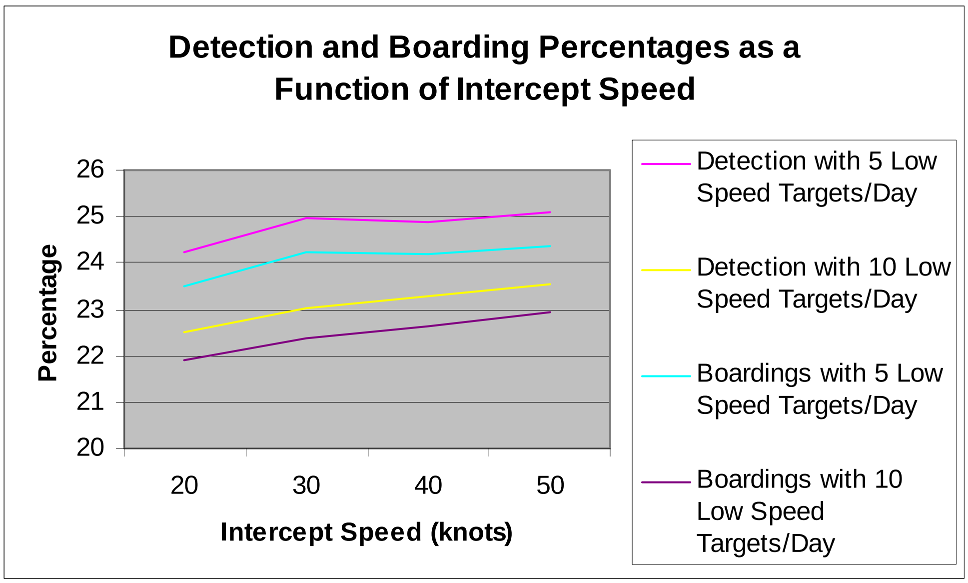


Figure B-2: Detections and Boardings of Low-Speed Targets

Key Points:

- Between 20% and 25% of the targets are detected, slightly better than for the high-speed targets, because at lower speeds they stay in the patrol area longer.
- Not quite all of the detected targets are intercepted, and there is a consistent difference between the percentage detected and percentage boarded, at all intercept speeds.

Targets detected and boarded were less than anticipated by the M&S Team. The team hypothesized that the ships' sensor range was the limiting factor. A follow-on study was designed to investigate the hypothesis.

Follow-on Study 1.1: Sea Fighter Sensor Range

Background: If the patrol vessel is not seeing many targets, it would not have the opportunity to intercept many of them. To study this, two extra situations were considered. The first doubled the range of the patrol vessel's sensor from the base range, and the second multiplied the range by a factor of ten. Each of the target scenarios from Primary Study 1 was run for 20, 30, and 50 kt intercept speeds at each of the three ranges, the base range, two times the base range, and ten times the base range.

Figure B-3 shows the detection and boarding percentages for a patrol vessel with the base sensor range for both the high- and low-speed target scenarios at each of the three intercept speeds.

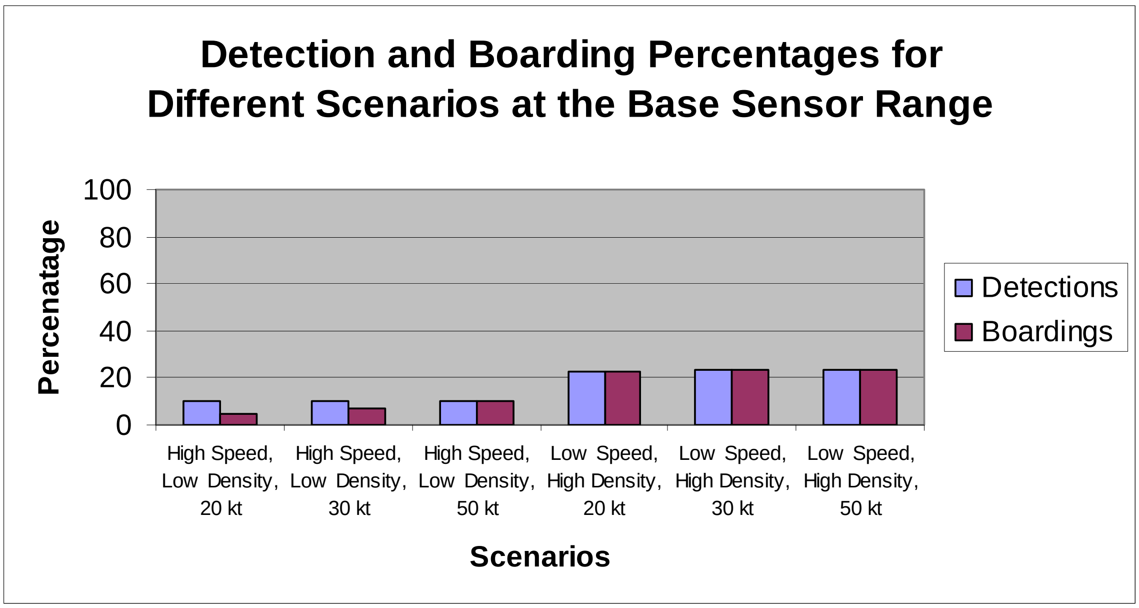


Figure B-3: Detection and Boarding Percentages at Base Sensor Range

Key Points:

- Only 10% of the high-speed targets and 25% of low-speed targets are detected.
- As long as the patrol vessel is faster than the target, almost all of the detected targets will be boarded.
- Since the low-speed targets are in the patrol area longer, they are more likely to be detected.

Figure B-4 shows the detection and boarding percentages for a patrol vessel with a sensor range twice that of the base sensor range for both the high-speed and low-speed target scenarios at each of the three intercept speeds.

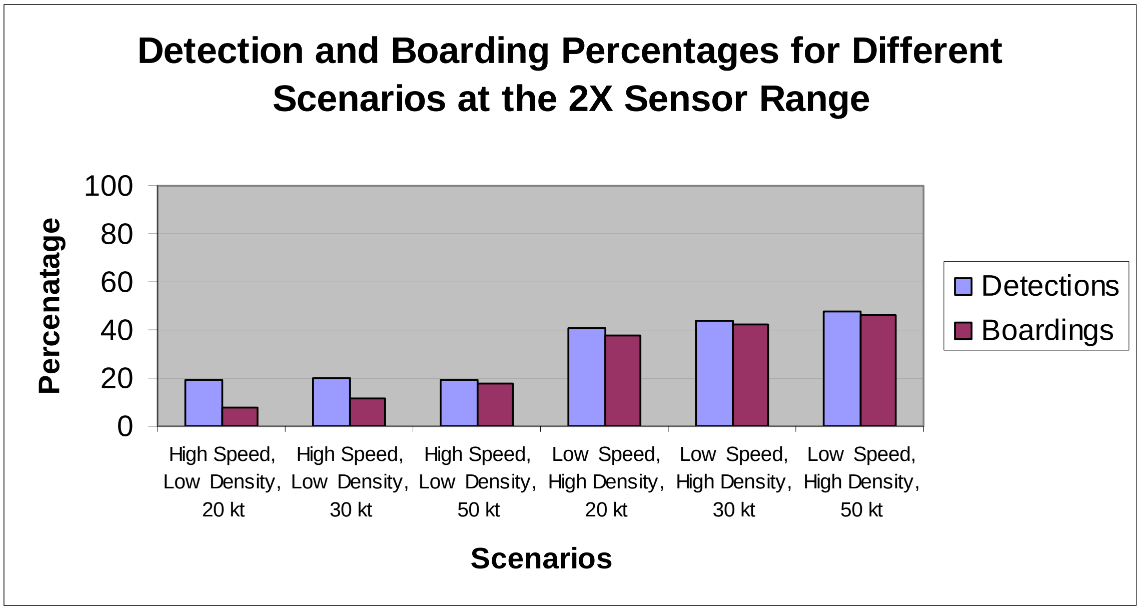


Figure B-4: Detection and Boarding Percentages at 2× Sensor Range

Key Point:

- The pattern is similar to Figure B-2, but with roughly twice as many of the targets detected and boarded as in the base case.

Figure B-5 shows the detection and boarding percentages for a patrol vessel with a sensor range ten times that of the base sensor range for both the high-speed and low-speed target scenarios at each of the three intercept speeds.

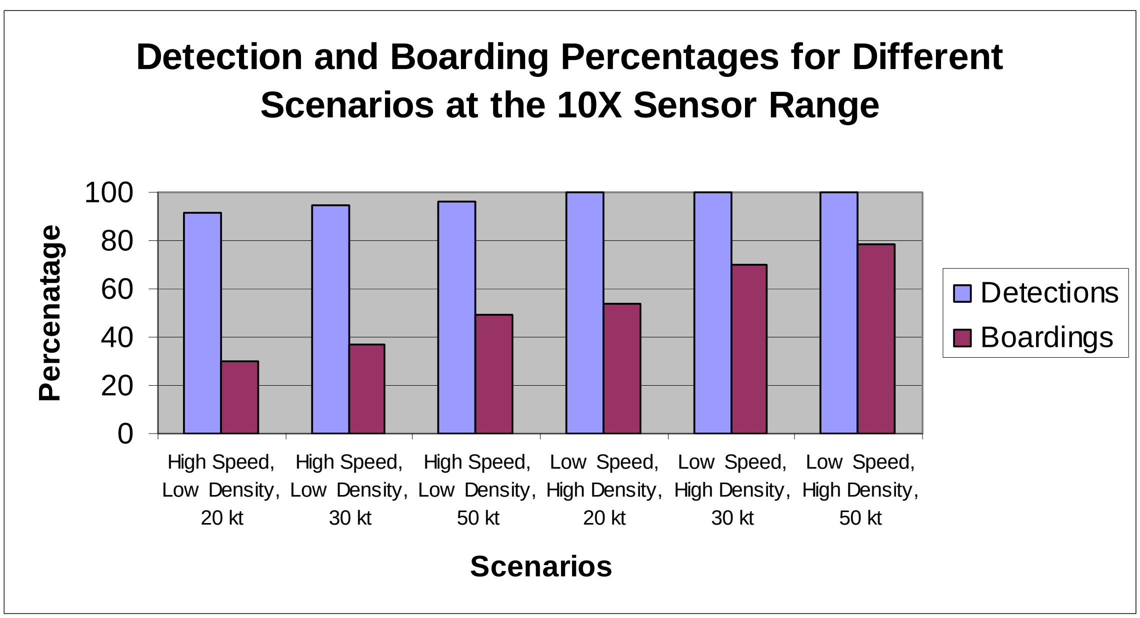


Figure B-5: Detection and Boarding Percentages at 10× Sensor Range

Key Points:

- Almost all of the targets are detected, so the fact that only a fraction of the targets are boarded is a limitation of the patrol vessel.
- A slow intercept against a fast target works about 30% of the time.
- A 50 kt intercept against the fast targets only worked about half the time, as was the case with a 20 kt intercept against a slower target.

A possible explanation is that the patrol vessel might not be able to intercept a target that is detected a long distance away within the patrol area when the difference between the target speed and the intercept is small. When the speed difference is great, as is the case of the 50 kt intercept against the slow-speed targets, most of the targets can be intercepted.

Follow-on Study 1.2: VUAV Surveillance

Background: The base range of the patrol vessel can be augmented by adding surveillance patrols to the patrol vessel using VUAVs. The case with air surveillance uses the high flight scenario from Table 16: Deployed Asset Flight Schedules from the **FSF-1 Modeling Engagement Model Scenario,** which includes simultaneous operations of two VUAVs for 15 hours per day. The sensor detection ranges for the patrol vessel are 18 nm for go-fast targets, 24 nm for large fishing vessels, and 20 nm for medium-size fishing vessels. For the air-based sensors, the detection ranges are 24 nm for go-fast targets, 36 nm for large fishing vessels, and 30 nm for medium fishing vessels. For the low-speed target cases, the 100% level represents ten targets per day; and for the high speed target cases, the 100% level represents five targets per day.

Figures B-6 and B-7 show the detection and boarding percentages with and without air surveillance for a patrol vessel capable of only one boarding at a time.

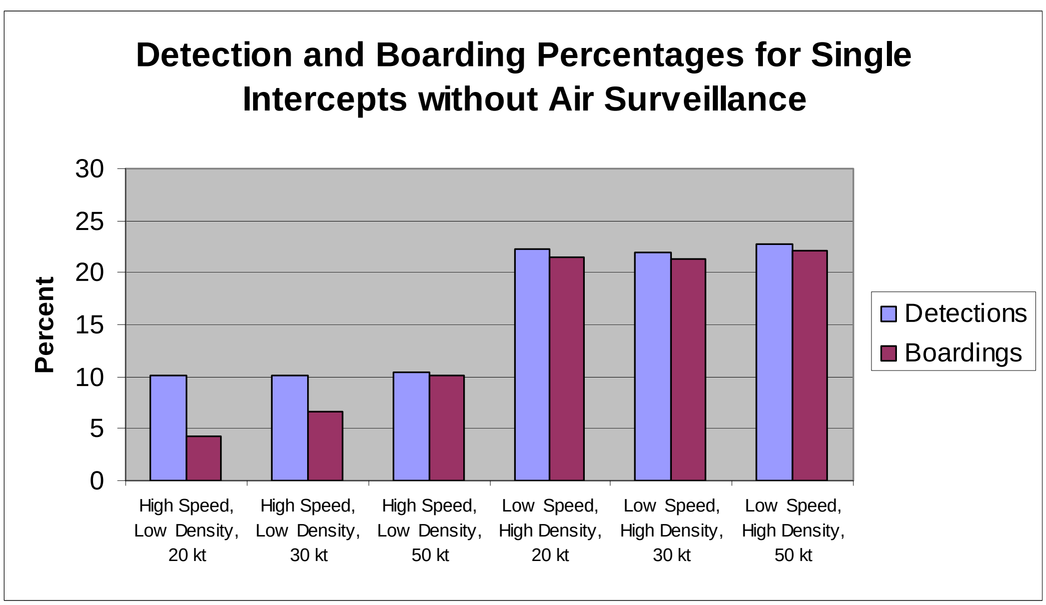


Figure B-6: Detection and Boarding Percentages for Single Intercepts without Air

Surveillance

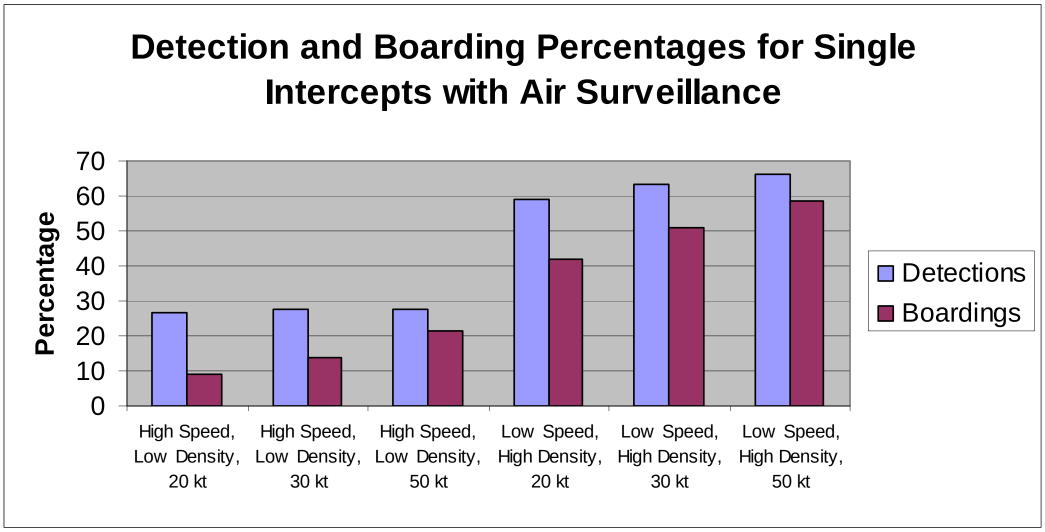


Figure B-7: Detection and Boarding Percentages for Single Intercepts with Air Surveillance

Figures B-8 and B-9 show the detection and boarding percentages with and without air surveillance for a patrol vessel capable of a second boarding using an OTH RHIB.

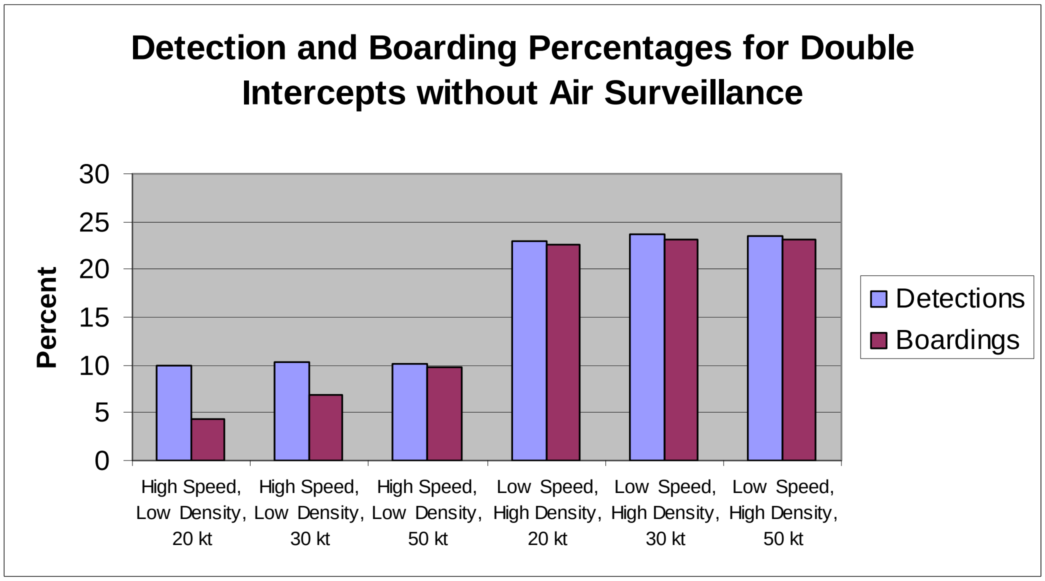


Figure B-8: Detection and Boarding Percentages for Double Intercepts without Air Surveillance

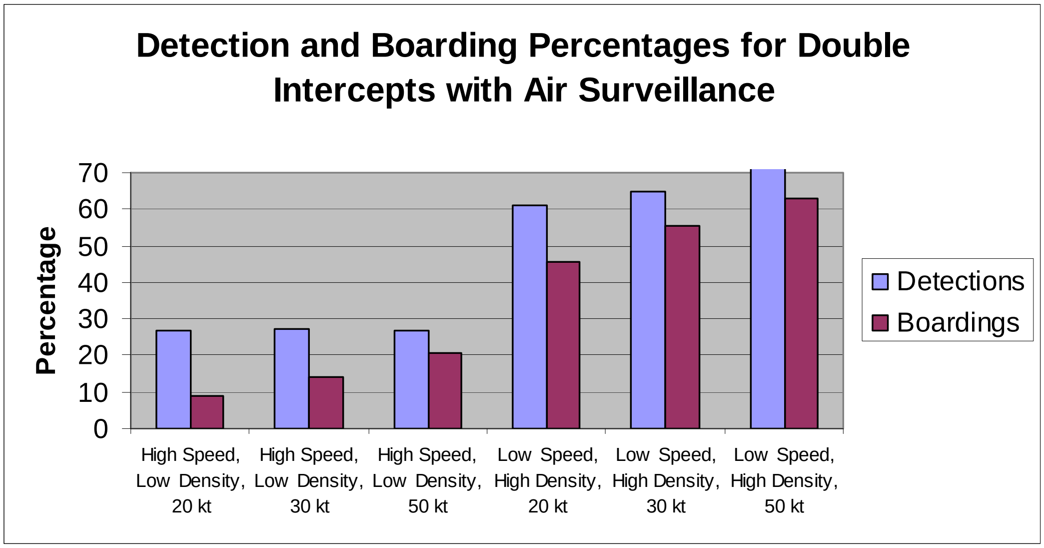


Figure B-9: Detection and Boarding Percentages for Double Intercepts with Air Surveillance

Figures B-10 and B-11 show the detection and boarding percentages with and without air surveillance for a patrol vessel capable of a third boarding using a helicopter.

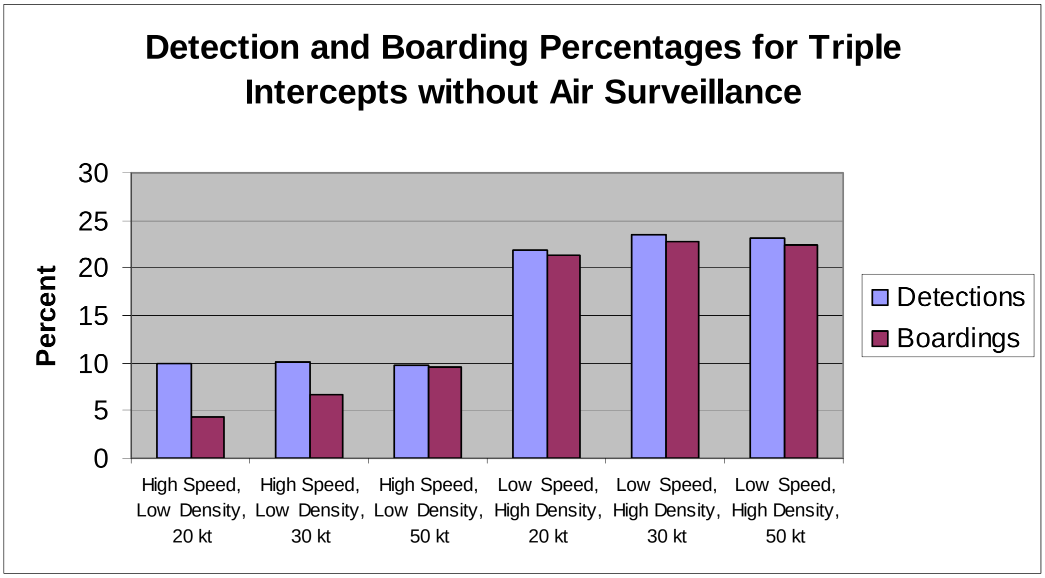


Figure B-10: Detection and Boarding Percentages for Triple Intercepts without Air Surveillance

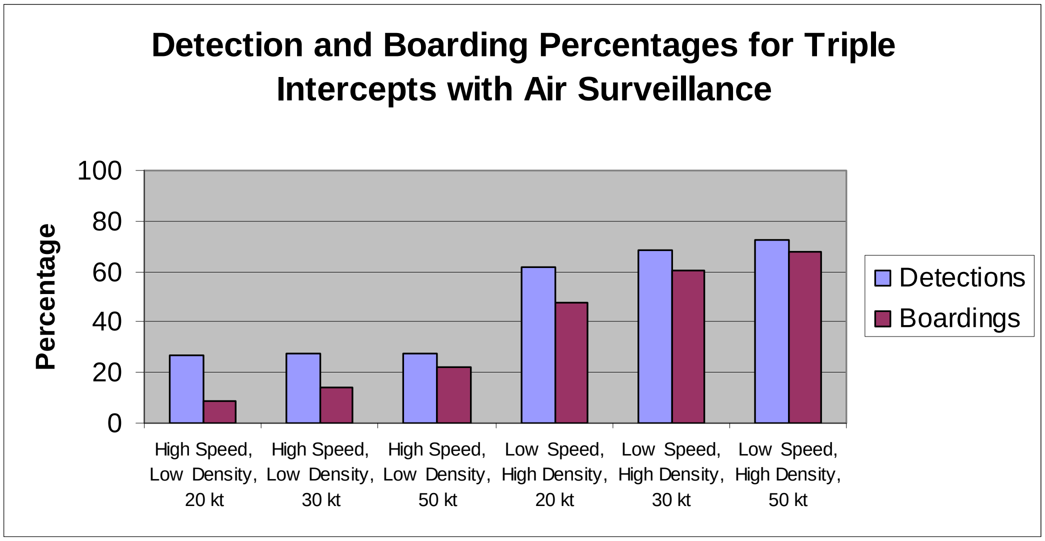


Figure B-11: Detection and Boarding Percentages for Triple Intercepts with Air Surveillance

Key Points:

- The addition of air surveillance triples the numbers of detections,
- The addition of air surveillance increases the number of boardings by a factor of 2 for all intercept speeds against high-speed targets, and for the 20 kt intercepts against low-speed targets.
- The addition of air surveillance increases the number of boardings by a factor of 2½ for 30 knot intercepts against the low-speed targets
- The addition of air surveillance increases the number of boardings by a factor of 3 for 50 knot intercepts against low-speed targets.
- Against the high speed targets, increasing intercept speed increases the number of boardings both with and without air surveillance. However, for the low-speed targets, if there is no air surveillance, it does not matter what intercept speed is used. Only when the air surveillance is added does the increased intercept speed have an advantage.

Note that the percentage of boardings only increases slightly with the addition of more boarding assets. This small change may be a result of the constraint on the distance from the patrol vessel that intercepts can take place. When the intercept speed is 20 kts (max distance from the ship is 40 nm), the target densities don't allow for many potential additional targets. When the intercept speed is 50 kts (max distance from the ship is 100 nm), there are more potential targets, but this is partially offset by the ability of the ship to catch up to most of them even without the additional deployable assets.

Follow-on Study 1.3: Full Patrol Area Detection (e.g., full Maritime Domain Awareness)

Background: Since additional MDA provides benefits to the percentage of targets boarded, the next study involved testing the effect of having complete maritime awareness by having fixed-

wing assets doing overflights to provide 100% MDA for different percentages of time. For example, 10% coverage represents having 100% MDA for 2.4 hours a day. During the rest of the day, the only sensor coverage is the base sensor capability of the patrol vessel. For the high-speed target set, 100% represents five targets per day. For the low-speed target set, 100% represents ten targets per day.

Figure B-12 shows the detection and boarding percentages for each of three intercept speeds (20, 30, and 50 kts) as a function of the percentage of time 100% MDA is available to detect low-speed targets.

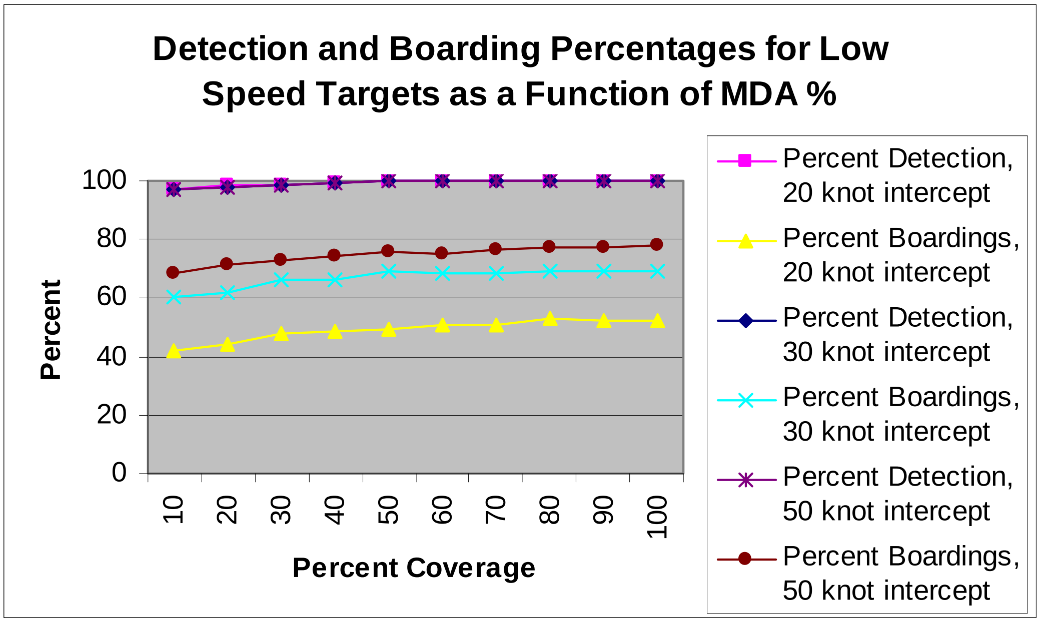


Figure B-12: Detection and Boarding Percentages for Low-Speed Targets as a Function of MDA%

Key Points:

- The maximum detection effectiveness is already achieved with only 10% coverage. The targets move slowly enough that only occasional views are sufficient to keep track of them.
- Faster intercept speeds increase the percentage of targets boarded.
- Most of the possible boardings can be done with only 10% coverage, but additional coverage allows more boardings because the initial detections are more timely.

Figure B-13 shows the detection and boarding percentages for each of three intercept speeds (20, 30, and 50 kts) as a function of the percentage of time 100% MDA is available to detect high-speed targets.

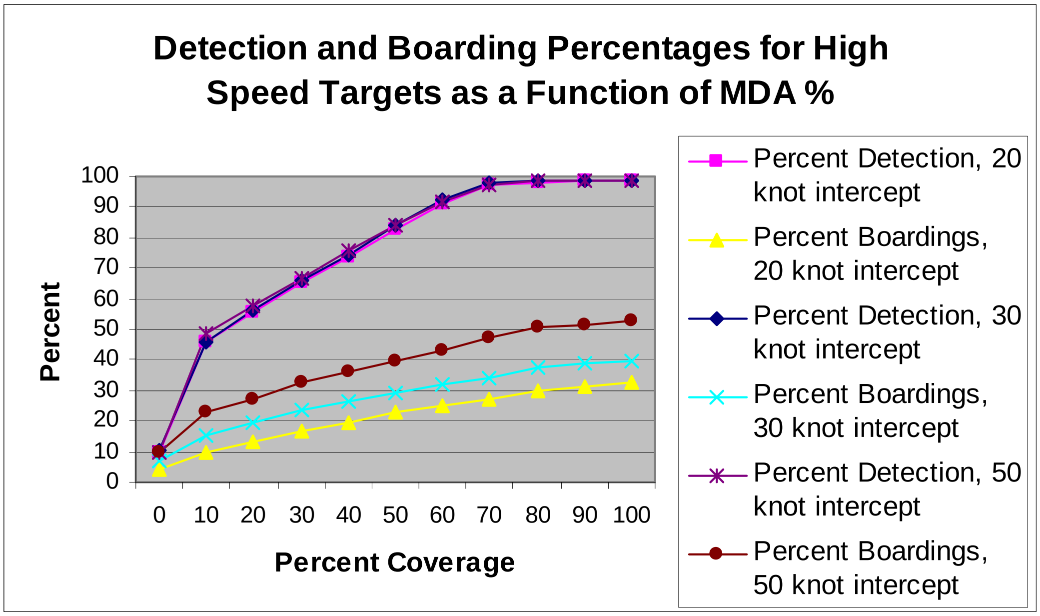


Figure B-13: Detection and Boarding Percentages for High-Speed Targets as a Function of MDA%

Key Points:

- The maximum detection effectiveness is achieved with 70% coverage. The targets move fast enough that MDA must be consistent for all of the targets to be detected.
- Faster intercept speeds increase the percentage of targets boarded.
- Increasing coverage leads to increased boardings. Even after 70% coverage, more boardings are done because the initial detections are more timely.

Another way to look at the MDA issue is to examine how detections and boardings are affected by sensor range. Having complete knowledge of all of the targets may not be helpful if some of the targets are too far away to be intercepted.

Figure B-14 shows the effect of increasing the sensor range for intercepting low-speed targets. The base range for detecting large fishing vessels is 24 nm and for medium fishing vessels is 20 nm. There are ten targets created per day.

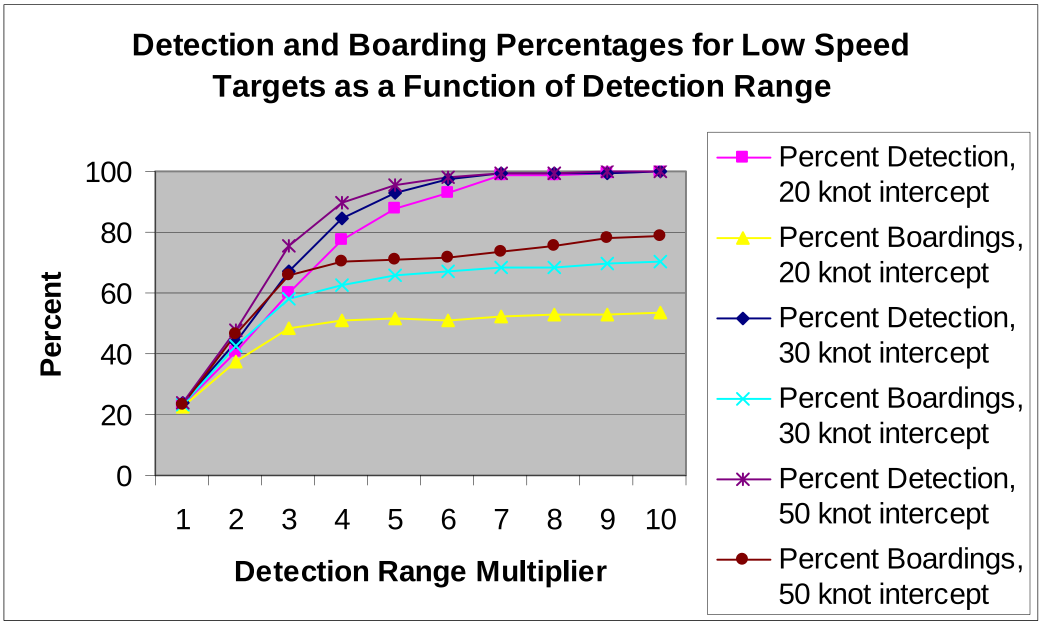


Figure B-14: Detection and Boarding Percentages for Low-Speed Targets as a Function of Detection Range

Key Points:

- In each case – 20, 30, and 50 kts – there seems to be a point at three times the base range where the patrol vessel is saturated with targets, and there is little extra advantage to adding more range.
- The only difference is that the saturation is at higher levels for higher intercept speeds, at about 55% (5.5 boardings per day) for 20 kt intercept speeds, 70% (7.0 boardings per day) for 30 kt intercept speeds, and 80% (8.0 boardings per day) for 50 kt intercept speeds.

Figure B-15 show the effect of increasing the sensor range of the patrol vessel for intercepting high-speed targets. The base range of the patrol vessel for detecting the high-speed target is 18 nm. There are five targets created per day.

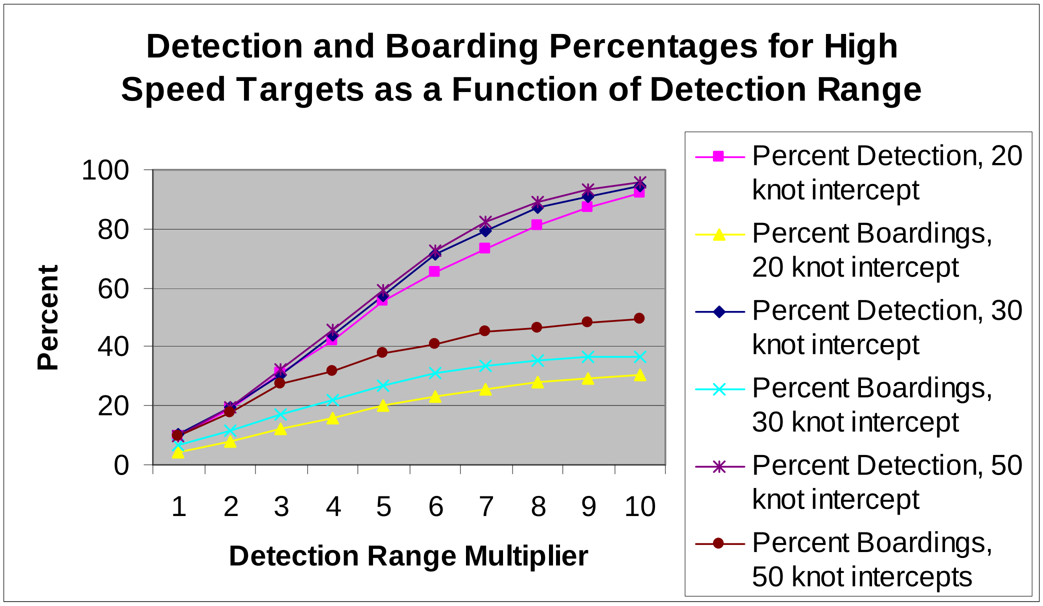


Figure B-15: Detection and Boarding Percentages for High-Speed Targets as a Function of Detection Range

Key Points:

- At an intercept speed of 20 kts, the patrol vessel loses its ability to intercept all detected targets at very low multiples of the sensor range.
- At an intercept speed of 30 kts, the fall off is not as dramatic, but the patrol vessel still is unable to intercept all of the detected targets.
- At an intercept speed of 50 kts, the patrol vessel can intercept nearly of the detected targets up to a detection range of three times the base range.
- The percent boardings continually increases as the detection range increases since the extra range gives more advanced warning of the targets. However, at 20 kt intercept speed, at best only 30% (1.5 per day) were intercepted; at 30 kt intercept speed, 40% (2.0 per day) were intercepted; and at 50 kt intercept speed, 50% (2.5 per day) were detected.

Primary Study 2: Target Vessel Boardings via 2 RHIBs and 1 Helicopter

Background: Primary Study 2 was done to determine the additional benefit of having a helicopter available for doing boardings, in addition to the two small boat boardings previously allowed. A sensor with a detection range ten times the base range was attached to the patrol vessel in order to mimic complete MDA. For the high-speed targets, the 100% levels represent five targets per day. For the low-speed targets, the 100% levels represent ten targets per day.

Figures B-16 and B-17 show the results for the high-speed/low-density, and low-speed/high-density target sets, at each of three intercept speeds (20, 30, and 50 kts). Figure B-16 shows the results for a patrol vessel without the extra helicopter; Figure B-17 shows the results for a patrol vessel with the extra helicopter.

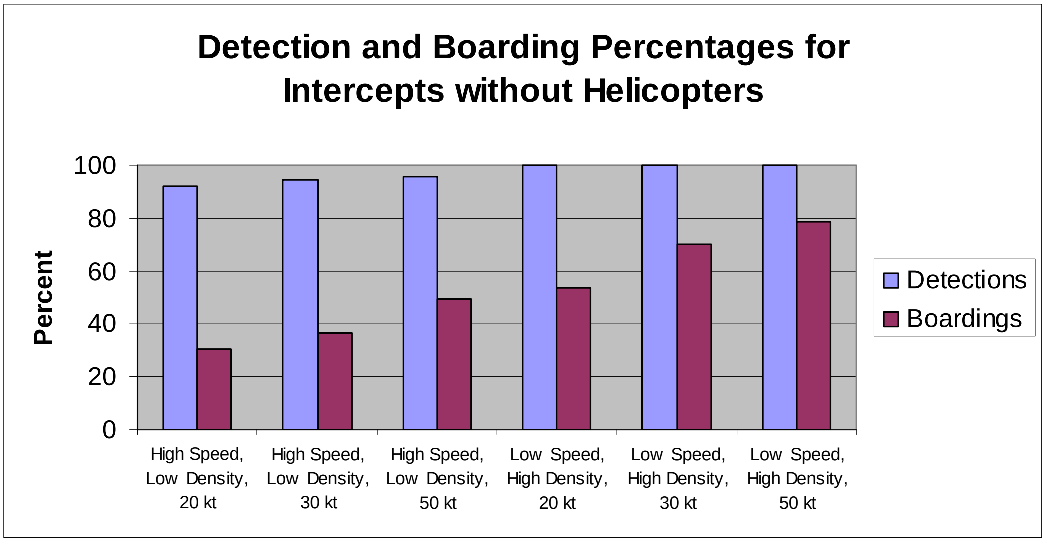


Figure B-16: Detection and Boarding Percentage for Intercepts without Helicopters

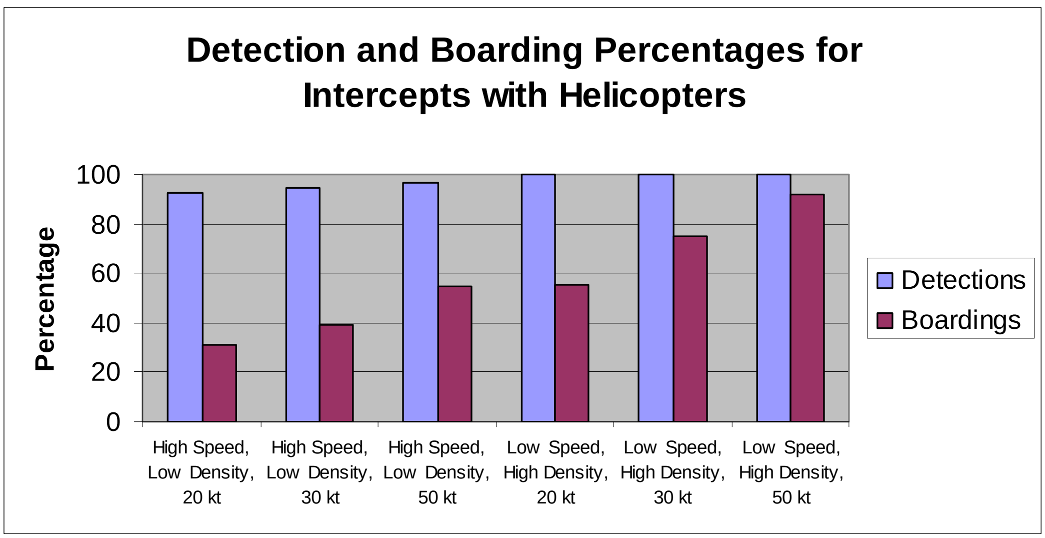


Figure B-17: Detection and Boarding Percentages for Intercepts with Helicopters

Key Points:

- There is more advantage to having the helicopter for greater intercept speeds.
- There is more advantage in the low-speed/high-density target case than in the high-speed/low-density case.

This result shows that the number of available targets is dependent on their density and on the restriction that no intercept may take place more than two hours' intercept distance from the patrol vessel. At low intercept speeds, the area in which targets can be found is small; at low densities, the number of targets is small. Only with high density of targets and a larger area to consider is an effect seen.

Primary Study 3: Sea Fighter Fuel Consumption

Background: This study evaluated whether Sea Fighter could remain on station for the entire patrol period without refueling, since high-speed vessels consume significant amounts of fuel at intercept speed. Early departure from the patrol area would result in reduced coverage and thus reduced mission effectiveness based on targets detected and boarded. The base-deployable asset case with no aircraft and two simultaneous boardings was used. Table B-1 shows the fuel consumption rates used at each of the speeds of interest.

Table B-1: Fuel Consumption Rates

Speed	Fuel Usage Rate
3 kt loiter speed	5.4 gallons/hour
12 kt patrol speed	97.0 gallons/hour
20 kt transit/intercept speed	493.0 gallons/hour
30 kt intercept speed	1,942.0 gallons/hour
50 kt intercept speed	4,243.0 gallons/hour

Table B-2 shows the amount of fuel used in both of the scenarios at each of three intercept speeds.

Table B-2: Fuel Used in Various Scenarios

Case	Fuel Used
High Speed Targets/Low Density, 20 kt Intercept Speed	45,400 gallons
High Speed Targets/Low Density, 30 kt Intercept Speed	53,500 gallons
High Speed Targets/Low Density, 50 kt Intercept Speed	63,000 gallons
Low Speed Targets/High Density, 20 kt Intercept Speed	48,500 gallons
Low Speed Targets/High Density, 30 kt Intercept Speed	73,750 gallons
Low Speed Targets/High Density, 50 kt Intercept Speed	92,500 gallons

Key Points:

- In all of the cases, the amount of fuels is less than the expected fuel capacity of approximately 144,000 gallons (160,000 gallons minus 10% fuel reserve).
- The amount of fuel used increases as the intercept speed increases.
- More fuel was used in the low-speed/high-density case than in the high-speed/low-density case, since more intercepts were accomplished, and the difference between the fuel used in the low-speed intercept and high-speed intercept is greater.

Primary Study 4: Target Vessel Boardings via 2 - 11m RHIBs and 2 - HH60 Helicopters

Background: A fully capable Sea Fighter should be able to use two RHIBs and two helicopters for boardings. This study showed the effects of having all of those resources available at different intercept speeds and in the high-speed/low-density and the low-speed/high-density target sets. The studies were done with the patrol vessel just having its base sensor, and also for the patrol vessel having a hypothetical sensor with ten times the range of the base sensor. In all cases, 100% detection or boarding represents five targets per day for the high-speed/low-density targets, and ten targets per day for the low-speed/high-density targets.

Figure B-18 shows the results for the different target scenarios and intercept speeds for the assets, when they can not conduct a boarding more than two hours' distance from the patrol vessel at the patrol vessel's intercept speed.

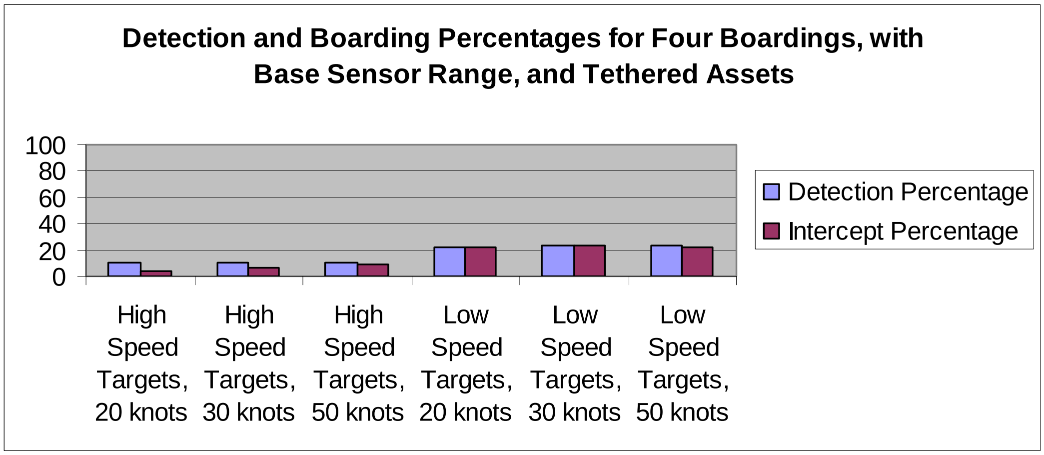


Figure B-18: Detection and Boarding Percentage for a Patrol Vessel with the Base Sensor Range and Two Tethered RHIBs and Two Tethered Helicopters

Key Point:

- The extra assets do not change the results from the base case with two small boats (Figure B-3), since not many targets are seen.

Figure B-19 shows the same scenarios with a sensor range ten times the base range so that the patrol vessel is not detection limited.

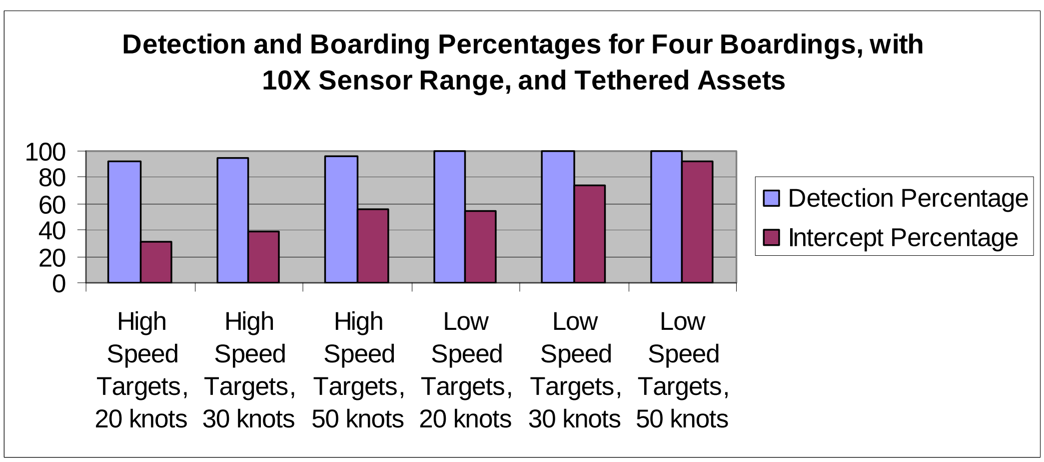


Figure B-19: Detection and Boarding Percentage for a Patrol Vessel with the 10× Sensor Range and Two Tethered RHIBs and Two Tethered Helicopters

Key Points:

- At low intercept speeds, there is only a small advantage compared to the base case (Figure B-5) to having the additional helicopters, since the restriction on the distance from the patrol

vessel limits the number of targets eligible for intercepts

- At high intercept speeds, the additional targets available allow the helicopters to add more intercepts.

Follow-on Study 4.1: Target Vessel Boardings via 2 - 11m RHIBs and 2 - HH60 Helicopters (Untethered)

Background: In all previous studies, there was a restriction on the deployable assets being allowed to travel a maximum distance from the patrol vessel that represents two hours of travel time at intercept speed for the patrol vessel. This restriction may be inhibiting the deployable assets, from getting to targets they could otherwise intercept. To study the effects, a series of tests were done in which the deployable assets were allowed to travel up to two hours at their own intercept speed from the patrol vessel. The studies were done with the patrol vessel just having its base sensor, and also for the patrol vessel having a hypothetical sensor with ten times the range of the base sensor. In all cases, 100% detection or boarding represents five targets per day for the high-speed/low-density targets and ten targets per day for the low-speed/high-density targets.

Figure B-20 shows the results for the scenarios for the base sensor range.

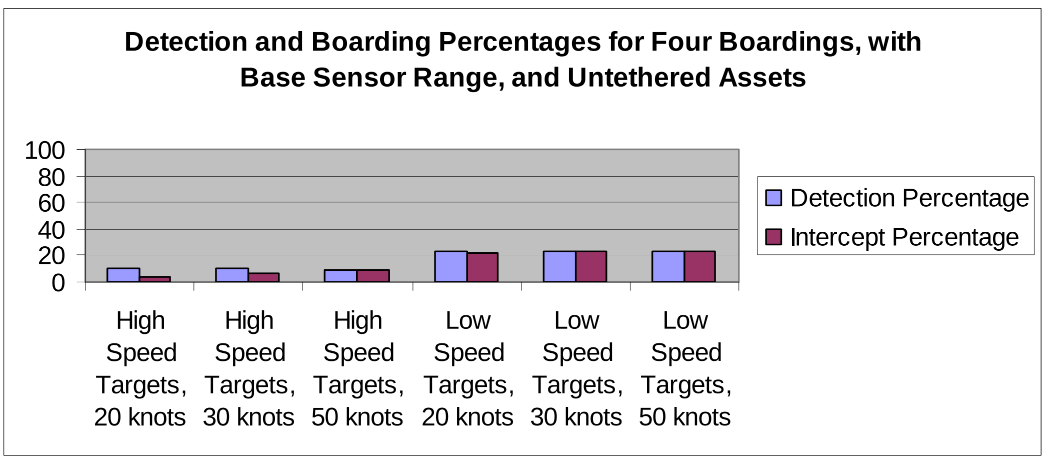


Figure B-20: Detection and Boarding Percentage for a Patrol Vessel with the Base Sensor Range and Two Untethered RHIBs and Two Untethered Helicopters

Key Point:

- In none of the cases does removing the restriction of distance from the patrol vessel substantially change the results.

This result is not surprising, since the patrol vessel does not see any targets beyond the maximum detection range previously defined, so allowing a greater maximum intercept range does not change anything.

Figure B-21 shows the results for the scenario for a sensor range ten times the base range.

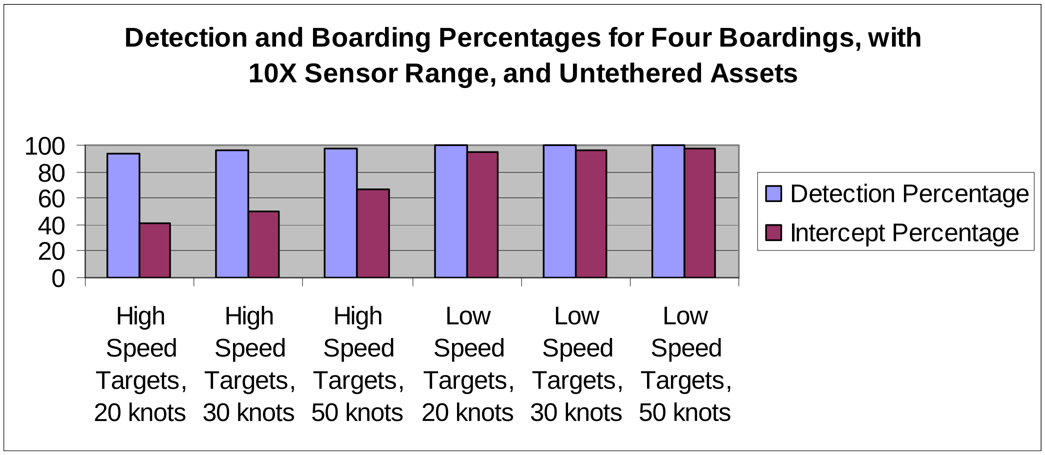


Figure B-21: Detection and Boarding Percentage for a Patrol Vessel with the 10× Sensor Range and Two Untethered RHIBs and Two Untethered Helicopters

Key Points:

- For the high-speed targets, relaxing the restrictions increases the number of boardings by 10% or 11% (0.5 targets/day, or 7 to 8 targets over the course of the patrol).
- For the low-speed targets, the amount of advantage depends on the intercept speed. When the intercept speed is 20 kts, the increase is ~40% (4 targets per day, or more than 50 targets over the course of the patrol).
- When the intercept speed is 30 kts, the increase is ~20% (2 targets per day, or roughly 30 targets over the course of the patrol).
- When the intercept speed is 50 kts, the advantage is less than 5%, since even without the restriction 90% of the targets are boarded.

B.4 through B.7

These subsections of Appendix B are published separately as stand-alone Excel workbooks containing the detailed outputs from the Engagement Modeling studies.

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APPENDIX C. HUMAN SYSTEMS INTEGRATION MODELING

This appendix is published separately on a CD-ROM due to the volume of the appendix.

APPENDIX C. HUMAN SYSTEMS INTEGRATION MODELING

C.1 Model Overview & Organization

The TCM is a dynamic simulation architecture built using the task-network modeling tool, Micro Saint, which was initially developed to simulate shipboard manning requirements for U.S. Coast Guard and Navy surface vessels. It was found that the development of crew schedules and watch quarters and station bill (WQ&SB) assignments in a static fashion often left gaps or inconsistencies that were not easily uncovered, but would reveal themselves in a dynamic environment. Therefore the TCM was developed to look at manning demands from a dynamic perspective to determine the adequacy of a proposed crew complement. In order to do this, the simulation considers the combined effects of crew complement, daily schedules, WQ&SB assignments, and specific manning requirements for special evolutions and other crew activities. These input data are integrated dynamically over the course of a designed reference mission scenario to assess the adequacy of the proposed manning structure in performing this scenario.

Simulation results are used to determine if the assigned crew complement can successfully accomplish all underway operations and do so within acceptable crew fatigue levels. Adjustments can be made to the manning hypotheses with the goal of optimizing the crew size while meeting crew performance and fatigue goals.

The TCM consists of a series of asynchronous (non-networked) tasks that represent every task type performed by the crew (Figure C.1-1). These include all daily scheduled tasks such as sleep, personal time, standing watch, eating meals, quarters, etc. In addition, all shipboard special evolutions such as flight quarters, briefs, drills, and inspections are also modeled as independent tasks. These tasks can change from platform to platform being modeled as required. The TCM represents each crewmember as a single entity that runs through the model, moving from task to task as dictated by their prescribed schedule and by evolutions that are triggered by the scenario.

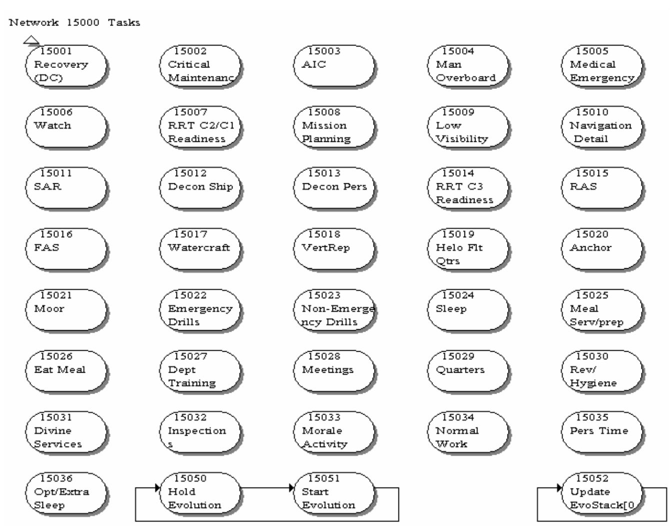

Figure C.1-1: Example of TCM Tasks

C.1.1 Model Inputs

All model input data are held in a Microsoft Excel workbook consisting of a set of individual input sheets. This allows for the vast majority of model building to occur within software that is familiar to most people and is easily modified. Each of these input sheets is then fed into the Micro Saint model, which interprets the input during a dynamic simulation run. Each of the major input components will be discussed in this section.

C.1.1.1 Crewmembers

The first set of input data is a list of all billets on the ship. This list contains billet numbers and other identifying information for each crewmember. This list can be used for reference and also contains attributes used in the fatigue calculations and to allow each individual crewmember to be selected for inclusion in the model run.

C.1.1.2 Daily Routines

All daily crew routines are coded into an Excel database, which is used by the model to drive the normal activities of the crew (Figure C.1-2). These routines consist of a sequential list of high-level tasks that would normally be performed by a crewmember. The types of tasks normally included in these routines include sleep, watch, meals, quarters, personal time, and normal work. One could create a library of schedules for use in the model, including watch rotations, food service schedules, non-watchstander schedules etc: These schedules are then assigned to individual crewmembers. The model supports the assignment of multiple schedules to each crewmember, and the applicable schedules are selected by the current readiness condition.

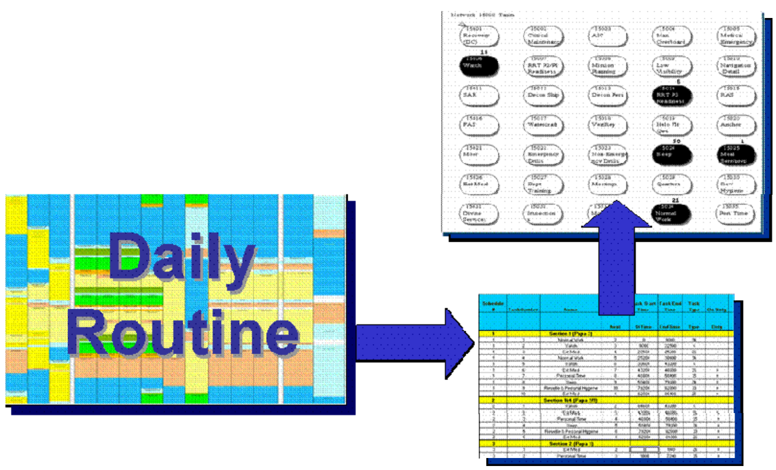

Figure C.1-2: Daily-Routine Schedules Are Driven from the Input Database

C.1.1.3 Watch, Quarter & Station Bill

There are two input sheets that are analogous to the WQ&SB (Figure C.1-3). These are the Resources and Logic sheets. In the Logic sheet, position or skill requirements are set for each type of evolution or activity. These positions or skills are then assigned to the appropriate crewmembers in the Resources sheet. Each evolution or activity has personnel requirements that

need to be met, and these requirements are satisfied by the selection of the appropriate crewmembers to perform these activities. This arrangement allows for the specification of manning requirements and skill allocations for evolutions to created and modified separately.

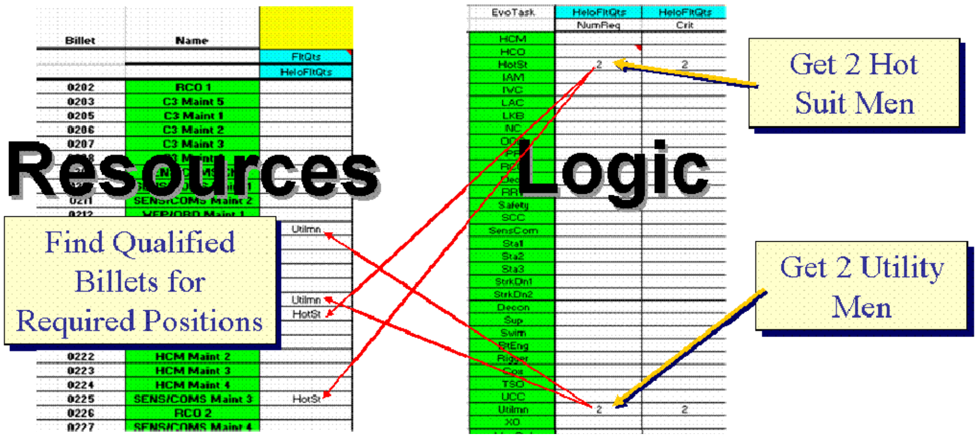

Figure C.1-3: Resources & Logic Sheet

C.1.1.4 Scenario

The scenario that is performed during a model run is a sequential list of all evolutions and readiness condition changes that occur during the specified time of the simulation. Each evolution is coded with a start time, duration, and other attributes that control some of the specific characteristics of evolutions that are performed during the simulation. Readiness condition changes are also coded in the scenario. These condition changes trigger daily routine changes for crewmembers.

A graphical form of the scenario used for the HSI modeling studies is shown in Figures C.1-4 and C.1-5. These figures contain an extract of the complete scenario for the first four days of the 14-day patrol; the first 12 hours of these four days are shown in Figure C.1-4; and the last 12 hours are shown in Figure C.1-5. Days 1 and 14 in this scenario include transiting to and from the patrol area; and Days 2 through 13 are patrol days. The first four days are typical of the remaining ten days in the scenario. The complete 14-day scenario is contained in Appendix C.2. For each day in the scenario, the leftmost column represents the daily shipboard routines and scheduled evolutions such as meals, drills, quarters, and evening reports. The next column to the right shows the scheduled flight operations, both manned and unmanned. The scenario shows manned flight operations early in the morning and late at night. As discussed in the findings, these flight operations were deleted (struck out in the scenario) in order to reduce crew fatigue to acceptable limits. The next two columns to the right show an average of three boardings per day and occasionally two simultaneous boardings.

The complete scenario includes the two activity priority matrices described in Section C.1.1.5.

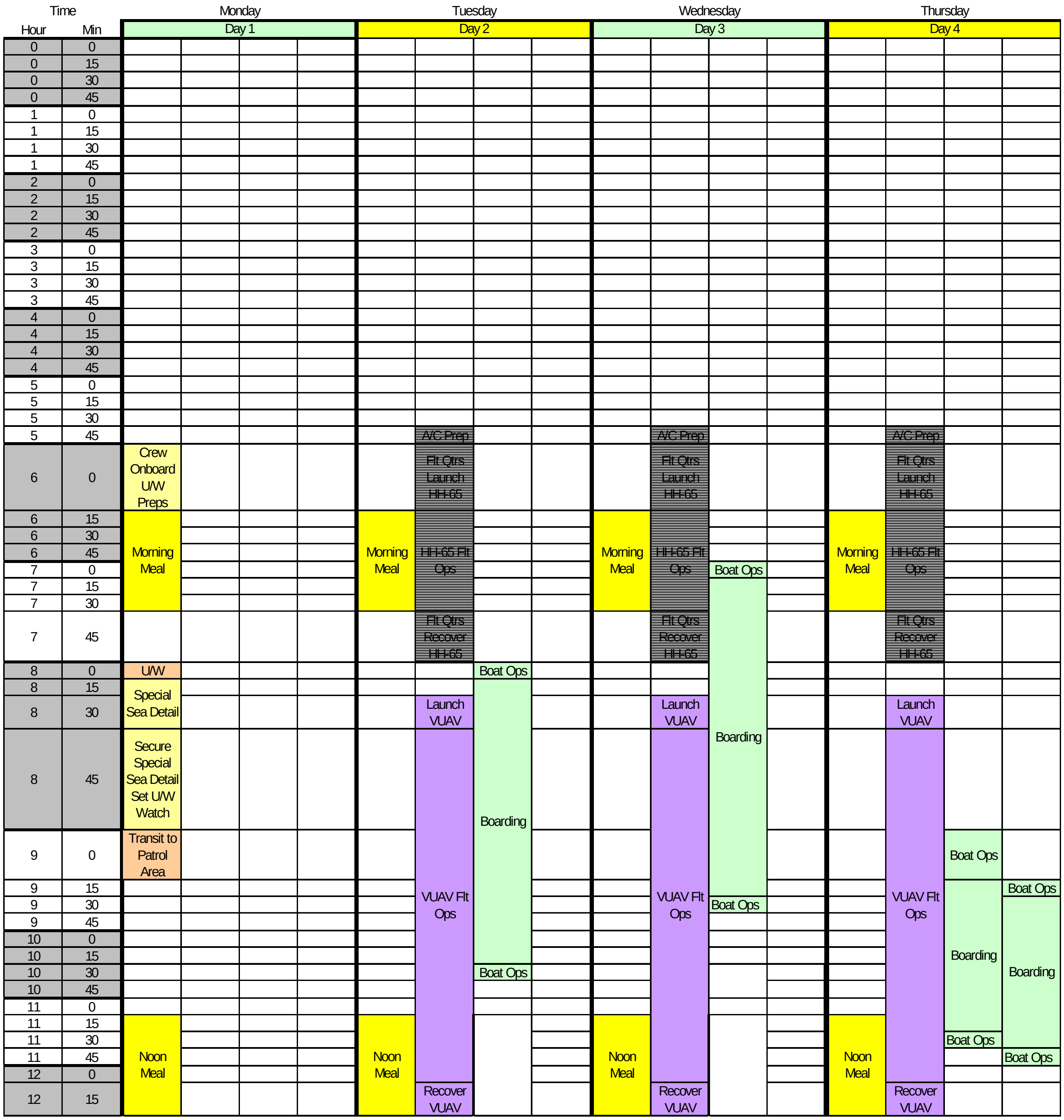

Figure C.1-4: Graphical Scenario (1 of 2)

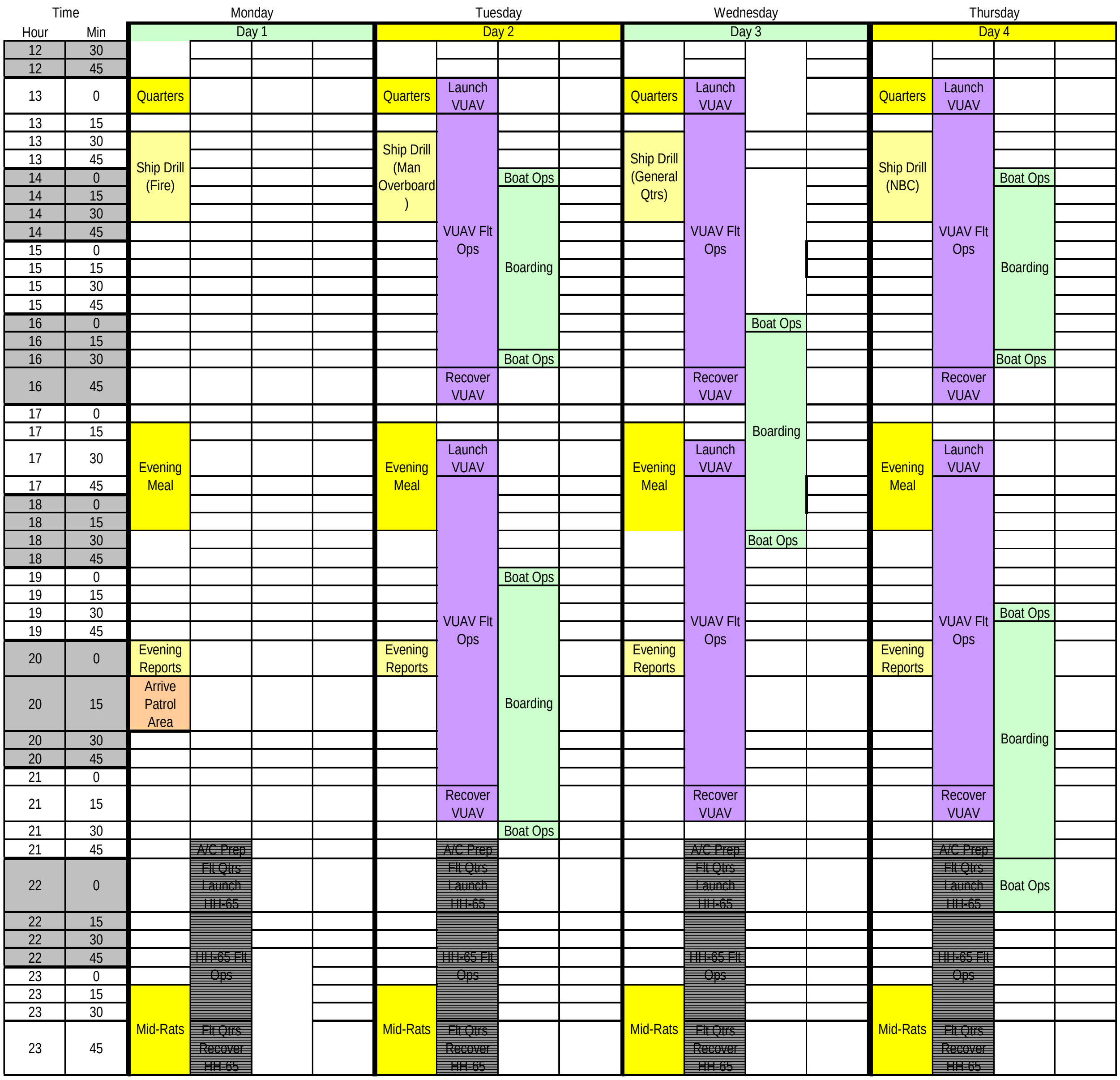

Figure C.1-5: Graphical Scenario (2 of 2)

C.1.1.5 Priority Matrices

In order to select the appropriate crewmembers to perform each evolution during the simulation, the model utilizes a pair of activity priority matrices. On of these is termed the Evolution Trump Matrix (Figure C.1-6). This matrix contains all possible activities that would be performed by crewmembers. These include all daily schedule activities in addition to all types of evolutions. Here, all individual pair-wise comparisons are made between each of these activities that show whether one activity can be interrupted or "trumped" by another.

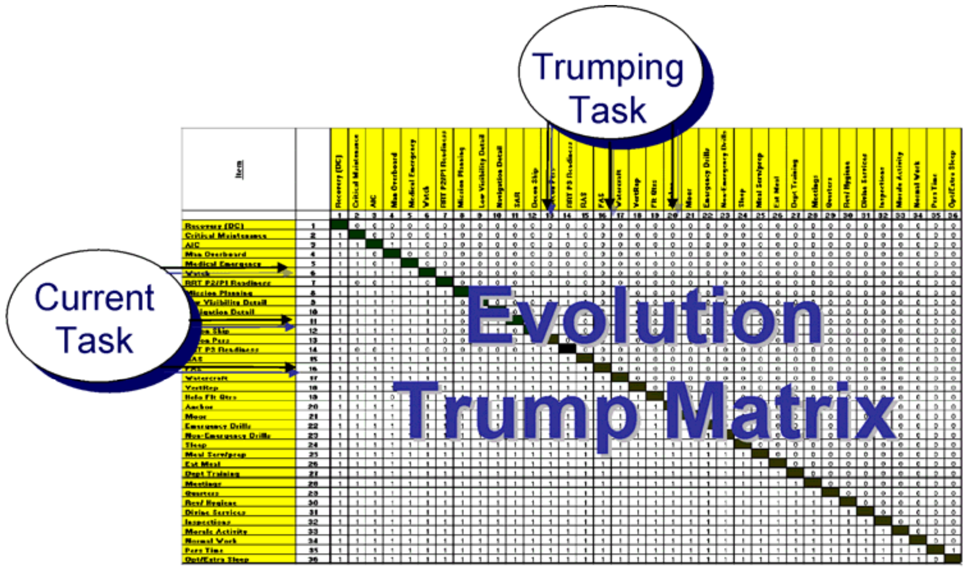

Figure C.1-6: Evolution Trump Matrix

A second priority matrix called the Condition Trump Matrix is similar to the Evolution Trump Matrix but comprises all evolutions and each readiness condition. In this priority matrix, each evolution is assessed for its applicability under each condition. This allows for the cancellation or interruption of evolutions when the readiness condition changes.

C.1.2 Model Execution

During the simulation, all crewmembers are started in their respective daily-routines. Evolutions coded in the scenario are then triggered at the appropriate times. These evolutions use the Resources and Logic sheet data in conjunction with the Evolution Trump Matrix to identify the appropriate crewmembers for that evolution.

Within this process, many evolutions have specified pass-or-fail criteria that are based upon filling certain critical positions, while other evolutions run with any available personnel. When evolution personnel requirements are not met, the evolution can either be delayed for a specified amount of time as coded in the scenario or can fail. If the evolution manning requirements are met, the identified crewmembers are pulled from their routine schedules and started into the appropriate evolution task. Upon completion of the evolutions, crewmembers are returned to their routine schedule tasks.

Additionally, changes in readiness condition appropriate to the scenario being simulated are triggered at specified times. These changes in condition alter the underlying schedules being performed by individual crewmembers as well as affect the ability of certain evolutions to be triggered. While these activities are occurring, fatigue estimates are being calculated on each member of the crew. These estimates are based primarily on the actual sleep/wake cycles experienced by crewmembers during the simulation. These fatigue estimates also affect the specific behaviors of individual crewmembers. Specifically, fatigue is one factor that goes into personnel selection for evolutions in that the model assumes a certain level of personnel management skill in selecting less-fatigued crewmembers for evolutions first. In addition,

crewmembers are allowed to opt to forgo personal time to sleep. This allows a crewmember to take steps to recover from excessive levels of fatigue.

C.1.3 Fatigue Analysis

A unique contribution of the TCM is to introduce an algorithm that estimates the fatigue induced by the fragmented and reduced sleep typical of operational scenarios that can dramatically impair the effectiveness of crews. The TCM incorporates this FAtigue DEgradation (FADE) equation, which predicts the current fatigue level for each crewmember of the vessel at any point in the simulation as they progress through their anticipated duties and special evolutions. The impact of different crew configurations, different watch rotation schedules, and other manning concerns can be compared and evaluated with this approach and provide a means to select the least fatigue degrading alternative.

C.1.3.1 Fatigue Equation in the TCM

Figure C.1-7 is an example of the application of the FADE equation in the TCM simulation. It demonstrates the estimated level of fatigue generated during the course of 15 days of sea duty. It can be seen that, during this crew configuration, these crewmembers are often above the fatigue level associated with the red Unacceptable region. Upon evaluation of the crewmembers' schedules and performed evolutions, its cause was determined to be a result of sustained night boarding evolutions.

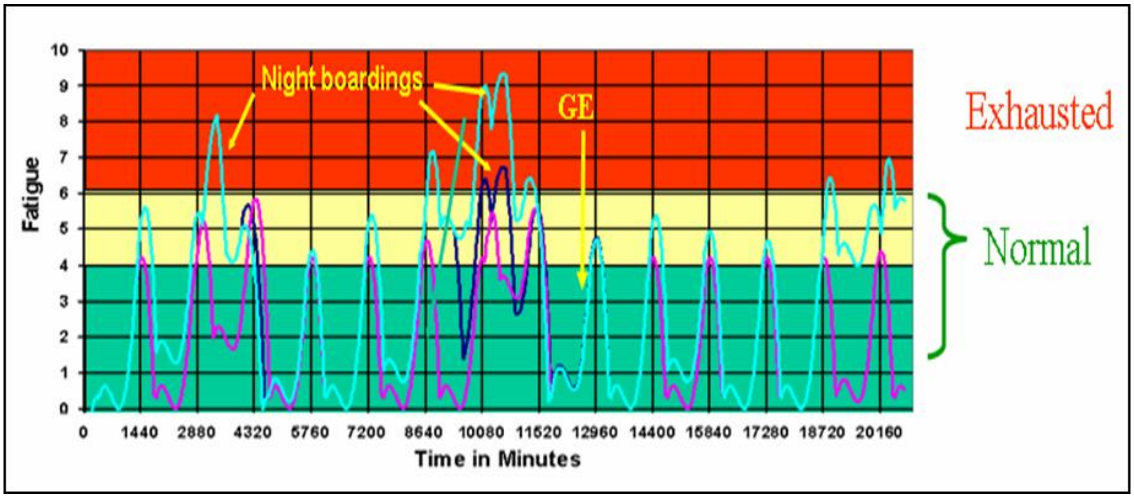

Figure C.1-7: Example of Fatigue Analysis Output from TCM

The application of the FADE equation in the TCM is demonstrated in other sections of this report by analyzing the impact of crew schedules and special evolutions on fatigue. Although the equation is still in development, it is currently robust enough to predict fatigue levels consistent with results found from other studies. It provides a rational, objective means to predict fatigue for managers, planners, and individuals. The model is an attempt to simulate important human limitations into complex models of human performance to increase the realism of operator performance predictions.

C.1.4 Model Outputs

C.1.4.1 Fatigue Charts

During the course of the simulation, fatigue estimates are computed and recorded for each crewmember every 15 minutes. This output data is subsequently graphed to create the kinds of fatigue curves illustrated in Figure C.1-7. As stated previously, the fatigue values correspond to the percentage of decrement in response time, and values greater than 6 are considered excessive fatigue. In addition, an output fatigue aggregate charts is created that summarizes the fatigue data for each crewmember and for the crew as a whole. These aggregate charts are a set of stacked bar charts that show the proportion of total scenario time spent in each region of fatigue. These are useful for quickly finding individuals with excessive fatigue levels.

C.1.4.2 Evolution Delays & Failures

Whenever an evolution cannot meet its prescribed personnel manning requirements, and either is delayed or fails, a record of this taken. This record includes the specific type of evolution, the time the event occurred, and the specific positions or skill types that were unable to be manned. Also, a unique evolution number is listed. This is a unique marker number for each evolution that originates from the scenario input data. This marker number allows one to trace the activities of an evolution.

C.1.4.3 Successful Evolutions

When an evolution successfully meets its manning requirements, a record of the evolution type, time, and each specific crewmember that participated in it is captured. Like the list of delays and failures, the unique evolution number is also listed.

C.1.4.4 Crew Activity Record

During the simulation, a record of every activity performed by each crewmember is recorded. This allows one to trace the specific activities performed by an individual crewmember in order to uncover sources of excessive fatigue or the failure of that crewmember to be selected for an evolution.

C.1.4.5 Task Type Breakouts

The total amount of time each crewmember spends performing each type of activity in the simulation is recorded. These records detail the total number of hours spent performing each type of evolution, standing watch, sleeping, eating, etc. This data allows for the computation of total work hours performed by each crewmember. It also allows comparisons of actual times spent doing each activity to Navy standard workweek requirements.

C.2 through C.15

These subsections of Appendix C are published separately as stand-alone Excel workbooks containing the input and output sheets for the 26-Person Crew Study and the Optimal Crew Study.

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APPENDIX D. CREW INSIGHTS

This appendix is published separately on a CD-ROM due to the volume of the appendix.

APPENDIX D. CREW INSIGHT INTERVIEWS

D.1 Crew Written Surveys Detailed Findings

This section presents observations and conclusions based on a review of the responses to the surveys by all respondents. Fifteen of the 16 U.S. Navy crewmembers responded; 9 of the 10 U.S. Coast Guard crewmembers responded. One response was received from Afloat Training Group, Pacific (ATG PAC), although this response was provided on two separate forms. Seven Navy crew members responded with minimal or no comments. One of these seven crewmembers responded to every question with the response "Somewhat Agree". One Coast Guard crewmember responded with minimal or no comments. The observations and conclusions have been categorized into four major categories relevant to the Sea Fighter and the critical operating issues (COI) associated with each category are noted. In addition the importance/significance of each observation and conclusion are indicated by dividing them into three groups: critical, important, or minor. "Critical" indicates a problem that seriously impacts operations and prevents the ship from being fully operational. "Important" indicates a problem that impacts the capabilities of the ship and prevents the ship from being fully operationally effective. "Minor" indicates a problem that does not impact operational effectiveness but affects crew comfort and efficiency of operations.

- **Characteristics** (includes COI 1 Speed, COI 2 Endurance, COI 3 Navigation, and COI 4 C5ISR)
    - Critical
        - CIC is not functioning, and there is no radar repeater in CIC.
        - The X-Y crane is inoperative, so it is unknown if this crew can effectively configure or reconfigure the ship with mission modules.
    - Important
        - There is no air search radar or IFF interrogation capability.
        - The Bridge on Sea Fighter is installed on the port side forward, which limits visibility close aboard on the starboard side and aft.
        - There is no access to Coast Guard publications.
    - Minor
        - Three personnel on the Bridge are sufficient for high-speed operations.
        - There is no designated area for trash; apparently trash is stowed in the Mission Deck.
        - There appears to be a need for additional washers/dryers and a larger refrigerator.
- **Crew** (includes COI 5 Crew Complement and COI 8 Crew Training)
    - Critical
        - There appears to be sufficient crewmembers to stand watches; however, there are inadequate personnel to simultaneously accomplish maintenance and manpower-intensive evolutions such as flight ops and boat ops.
    - Important
        - There appears to be a need for additional cooks.
- **Boat Operations** (includes COI 6 RHIB/SOLAS Boat Operations and COI 7 Deck Seamanship)

  - Critical
    - The process for launch and recovery of the SOLAS boat is considered unsafe.
    - The stern ramp is poorly designed and subject to frequent breakdowns.
  - Important
    - There appears to be an inadequate quantity of trained coxswains.
    - The 11m RHIB must be recovered with fewer than six persons on board (POB); the SOLAS boat must be recovered with fewer than two POB.

- **Communications** (includes COI 9 Internal Communications and COI 10 External Communications)
  - Important
    - There is no Coast Guard connectivity.
    - There is no comms gear installed on the SOLAS boat.
  - Minor
    - The 1MC cannot be heard throughout the ship, especially in the Mission Deck, flight deck, or aft mooring stations.

Summary of R&DC Observations during Test 1A and 2A.

The following is a summary of significant observations by R&DC personnel who were on board during the first two weeks of dedicated Coast Guard OT&E testing (Tests 1A and 2A).

- Of the total of nine exercises planned between 18 and 20 October 2005 (Test 1A), six were completed. Three were canceled due to unavailability of the 11m RHIB, a hydraulic oil leak in the water, and a casualty to the boat winch.

- Of the total of five exercises planned between 31 October and 2 November 2005 (Test 2A), one was completed. Four were canceled due to a casualty of the water jet hydraulic control system. In addition, lack of replacement gas turbine fuel filters required the only exercise to be conducted on diesel engines (no gas turbines).

D.2 Crew Interviews Detailed Findings

The analysis of crew interviews is presented in the following sections by subject areas which correspond to the list of guiding questions contained in Appendix D.5. The analysis focuses on the issues that emerged from the interviews that have significant beneficial or adverse impact on Sea Fighter operations.

Primary and Collateral Duties

Primary and collateral duties of the crew include standing watches, participating in various ship evolutions and working in one of the ship's departments such as engineering or communications. The issues and impacts on Sea Fighter operations that emerged from the interviews regarding the crew members' duties are presented in Table D-1.

Table D-1: Primary / Collateral Duties Issues and Impacts

Primary or Collateral Duties		Issues	Impacts
Underway Watches	Officer of the Deck (OOD)	• The MTU RCS-5 control system is very effective in maneuvering the vessel (steering and throttle) using either the T-handles on the Bridge console or OOD/NOOW joysticks • The Sperry Integrated Bridge and Navigation System (IBNS) provides the OOD and NOOW with full control over multifunction display consoles from a seated position using ergonomic armrest controls.	The Sea Fighter is highly maneuverable, it turns tightly, stops in a very short distance and can be walked sideways during docking evolutions. The IBNS significantly reduces the crewing requirements on the bridge and provides the OOD more immediate hands-on control of vessel operations.
	Navigation Officer of the Watch (NOOW)	The NOOW normally operates and handles communications using the Bridge VHF and HF/MF communications equipment. Sea Fighter has problems receiving VHF communications and, as delivered, was limited to line-of-sight communications	Communications problems adversely affect the ability of Sea Fighter to be fully interoperable with navy and OGA assets.
	Engineering Officer of the Watch (EOW)	The machinery spaces on Sea Fighter are unmanned. The EOW controls and monitors the main propulsion engines and all auxiliary machinery from the Engineer's watchstation on the Bridge. EOWs would prefer to stand their watch in the Engineering Operating Station, which they believe would eliminate the need for the Rover watch.	Effective control and monitoring of the machinery plant facilitates minimal manning and accurate record keeping. OODs liked the fact that the EOW was right behind them on the Bridge.
	Rover	This watch can be eliminated (as recommended by many of the crew) if the EOW were permitted to leave the Bridge for short periods to make routine rounds.	If the Rover watch were eliminated the number of underway watchstanders would be reduced from 4 to 3.

Primary or Collateral Duties		Issues	Impacts
Underway Watches (cont.)	Combat Information Center (CIC) / Tactical Action Officer (TAO)	• CIC is currently non-functional and therefore unmanned • The TAO watch is not a currently manned watch • Crypto-comms equipment is located in the two hulls; it is inconvenient and time-consuming to access this equipment. In heavy weather, this equipment is not accessible.	A non-functioning CIC/TAO would prevent effective operations with a Battle Group and prevent full interoperability with Navy and OGA assets.
In Port Watches	Command Duty Officer (CDO)	The Maintenance Support Team augments the crew in standing this watch when Sea Fighter is in port in San Diego.	The crew is relieved of some of the inport watchstanding responsibilities.
Other Assigned Duties	Cook	The consensus of the crew is that the Sea Fighter needs a second permanently assigned cook	A second cook has to be assigned TAD for underway periods.
	Corpsman	One corpsman is adequate for the 26-person crew given the ability of the Sea Fighter to rapidly evacuate injured personnel via helicopter	The corpsman's duties permit him to be assigned other duties facilitating minimal manning

Each crewmember is assigned to one of the ship's departments. Operation and maintenance of the ship's machinery and equipment are assigned to the various Departments. The issues and impacts on Sea Fighter operations associated with the ship's machinery and equipment are presented in Table D-2.

Table D-2: Equipment Issues and Impacts

Department	Equipment	Issues	Impacts
Deck	Mission Deck Isolation Doors	The two isolation roll-up doors on the Mission Deck are routinely inoperable which limits the use of the Mission Deck underway. Isolation doors were installed to divide the Mission Deck into three sections. The climate-controlled forward section accommodates mission modules and the elevator to the Flight Deck. The midsection is ventilated and provides access to the aviation refueling station, engine rooms, and the engineering operations station. The aft section is not ventilated and provides open access to the stern, the deployable surface asset stern ramp, the SOLAS boat, and exterior access to the flight deck.	Inability to isolate the stern section of the Mission Deck underway results in excessive noise stern wash spray and engine exhaust fumes on the Mission Deck. In addition isolation doors are needed to contain migrants in the midsection of the Mission Deck. The Mission Deck provides an outstanding containment area for holding detainees, for specialty teams to layout equipment and prep for boardings, and to prep additional deployable surface assets. However, none of this is safe and practical without fully operational isolation doors.

Department	Equipment	Issues	Impacts
Deck (cont.)	X-Y Crane	• Not designed for shipboard use • Cannot be used underway • Subject to frequent mechanical failure	The crane is required to relocate payloads (which include deployable surface assets) on the Mission Deck. Without this capability, Sea Fighter can only launch and recover one 11m RHIB (or 7m RHIB).
	Elevator	When fully lowered, the elevator platform is approximately 1.5 foot above the Mission Deck.	Difficulty moving cargo on and off the elevator. Compounding this problem is the fact that the X-Y crane cannot be used while the vessel is underway.
Communications	KU Band Satellite	The KU band satellite communications equipment is currently inoperable.	Prevents the Sea Fighter from being fully interoperable with Navy and OGA assets
Engineering	Sea Strainers	The ship is not equipped with duplex sea strainers	If the strainers clog with seaweed, all propulsion engines in the affected hull have to be shut down to permit cleaning the strainer.
	Fuel Filters	The Sea Fighter is not equipped with a lube oil or fuel oil purifier	The fuel filters serving the main diesel engines, gas turbines, and ship service generators have to be replaced frequently which is costly and time consuming

Habitability

Habitability issues involve the accommodation spaces on Sea Fighter. The issues and impacts on Sea Fighter operations associated with the accommodation spaces are presented in Table D-3.

Table D-3: Habitability Issues and Impacts

Accommodation Spaces	Issues	Impacts
Berthing Areas / Staterooms	Three person staterooms are well liked, but the consensus is that the rooms, lockers, and vertical separation between bunks are too small.	The small lockers prevent the crew from carrying all of the uniforms they would need for a patrol.
Galley/Mess Deck	• The Galley is adequately sized and equipped for a 26-person crew; however, it lacks hot wells and a milk dispenser, and the refrigerator is too small. • The dining area on the mess deck is carpeted. • Dry Stores consist of three open shelves.	The crew would prefer to a non-carpet deck covering which would be easier to keep sanitary. Lack of storage capacity affects the duration of a patrol
Heads	• The Heads are adequately sized and equipped for a 26-person crew and can accommodate a mixed-gender crew • There is no Head readily available to Bridge watchstanders	A watch relief is needed if a watchstander needs to use the head

Accommodation Spaces	Issues	Impacts
Crews Lounge / Recreation Areas	The first commanding officer converted the Wardroom to a Crew's Lounge. There is a common desire for additional accommodation space that would permit officers and chiefs to have lounge/recreational space separate from the crew.	Lack of places for the crew to go off watch adversely affects crew morale.
Office / Work Spaces	There is a general lack of office/work spaces that would permit the crew a place to go when off watch.	
All	In general the vessel is noisy at high speeds due to a combination of wind and water noise, in addition to the noise generated while operating on gas turbines. The requirement to wear hearing protection on the Mission Deck could be eliminated if the isolation doors on the Mission Deck were fully operational.	The noise is believed to have a negative impact on crew fatigue. Hearing protection must be worn to prevent hearing damage while on the Mission Deck.

Ride Quality / Speed

The crew generally believes the vessel's ride quality is better at higher speeds than at lower speeds, independent of sea state and wave period. Loitering results in the worst ride unless the sea conditions are very low (0 to 2 feet). At high speeds in low and high period waves the vessel skims over the tops of low period waves and follows the surface for long period waves. For medium period waves, high speed ride quality is reduced due to wave slamming on the wet deck. Wet deck slamming must be avoided to prevent structural damage, and in accordance with the ship's ABS certification, the ship must seek safe haven when seas exceed 13 feet.

The ride control system (T-foils, active skegs, and interceptors) does not have a significant impact on damping roll, pitch, and heave below 15 knots due to the reduced flow over those control surfaces. Vessel motions at low speeds can impact the launch and recovery of deployable assets. Reduced vessel motions at high speeds can permit the vessel to close on targets of interest quicker than existing or planned Coast Guard vessels.

Payload Flexibility

The Mission Deck can accommodate up to twelve mission modules in the form of ISO Containers (20' × 8' × 8'). Coast Guard vessels currently do not require modular mission capabilities since they are designed to be multi-mission capable. However there is an increased emphasis on combating maritime terrorism using specialty teams (MSRTs and MSSTs). The MSRTs and MSSTs are being outfitted with deployable modules (towable trailers) to accommodate their equipment. The crew generally believes the Mission Deck offers flexibility to quickly reconfigure the ship for different missions. Due to limitations associated with the X-Y crane, moving mission modules must be accomplished in port.

Boat Operations

Sea Fighter's boats consist of a single-point davit-launched Safety of Life at Sea (SOLAS) boat, shown in the figure, designed for man overboard situations and an 11m RHIB launched via the stern ramp.

The SOLAS boat was planned to be used for Man Overboard recovery operations. The launch and recovery requires the boat crew to board the boat on the boat deck (see photo), be swung out 180 degrees on a single point davit, and then be lowered approximately 30 feet to the water. This operation is extremely unsafe in any weather condition. Man overboard recovery is performed by the 11m RHIB via the stern ramp. By using the 11m RHIB for man overboard evolutions, the number of deployable surface assets carried by Sea Fighter would be reduced since one stern launch RHIB would have to remain in reserve in case of man overboard and flight operations.

Launching and recovering the 11m RHIB requires lowering the stern ramp to its maximum 17 degrees down angle and fully extending it. The RHIB is launched and recovered at ship speeds not exceeding 5 kts. At speeds less than 15 kts Sea Fighter's ride quality is reduced. Ship motions at 5 kts sometimes causes the end of the stern ramp to emerge from the water, which makes recovering the boat a challenge at best and dangerous at worst. A missed approach (to the ramp) could result in the boat being trapped under the waterjet guards.

The RHIB has to be powered up the ramp at full throttle, causing excessive wear and tear on the boat's engine and waterjet. An experienced and skillful coxswain is required to recover the boat under challenging sea conditions. The steep ramp angle and launch and recovery speed both impact the critical operation of surface deployable assets which are essential for boarding target vessels.

Manning / Preventive Maintenance

A high degree of automation, closed circuit television, and exploiting the latest technologies in integrated bridge systems permits this ship, similar in size to a medium endurance cutter, to be operated like a patrol boat with unmanned machinery spaces and with only four persons on watch (OOD, NOW, EOW and Rover). The number of crew needed to support flight operations was reduced to a minimum, and a maintenance support team ashore was created to accommodate the minimally manned crew on Sea Fighter.

Crew size of 26 personnel is adequate for standing underway watches but significantly limits sustained underway operations such as flight operations and boardings.

The shoreside Maintenance Support Team does not provide the augmentation of the crew required for preventive maintenance in port that was envisioned to support the Sea Fighter's small crew size. This Team however effectively maintains the 11m RHIB, orders spare parts, and augments the crew for inport (in San Diego) watches.

D.3 Detailed Analysis of Observations

Although 8 weeks were originally scheduled for Coast Guard OT&E, the Sea Fighter only conducted Coast Guard exercises and drills during the following periods:

- 18-20 October 2005. Completed six of the nine planned exercises. Three were cancelled due to unavailability of the 11m RHIB due to a hydraulic oil leak and a casualty to the boat winch.
- 31 October – 2 November 2005. Completed one of the five planned exercises. Four were cancelled due to a casualty to the water jet hydraulic control system.
- 1 to 4 May and 8-11 May 2006. Conducted exercises and drills, including Coast Guard mission exercises (MDA, Counterdrug, SAR, and AMIO), flight operations, vertical insertion of a Maritime Safety and Security Team (MSST), and a main space fire drill. In addition, special sea and anchoring details were observed during the transits in and out of port, and the conduct of the Bridge Management Team was observed.

Individuals representing the R&DC observed these exercises and drills. Telephone interviews of the HH-60 pilots, HH-65 pilots, and senior members of the MSST who participated in the May 2006 exercises were conducted. The CGC *Halibut* and Alameda County Sheriff's boat participated in these exercises, but their personnel were not interviewed.

The detailed analysis of observations is presented in the following sections organized by the exercises and drills that were conducted. The analysis focuses on the issues that emerged from the observations that have significant beneficial or adverse impact on Sea Fighter operations.

Special Sea and Anchor Detail / Mooring

In order to throw a heaving line for #1 line to linehandlers on the pier, a crewman must go outside through the centerline bow hatch and walk along the narrow bow catwalk to the pier side of the ship and throw the heaving line that has been tied to #1 line and led through the bow chock to another crewman standing in the vertical opening of the fo'c'sle. Sending a crewman outside the ship onto the bow catwalk is considered unsafe by the crew. The bow hatch, catwalk, and fo'c'sle opening are illustrated in the

Figure.

Bridge Resource Management

Occasionally, Bridge Resource Management is not totally effective. This is especially noticeable when the Bridge Team has multiple simultaneous tasks.

At night, several displays and monitors on the Bridge have to be covered with towels because they are bright and cannot be dimmed. The generally high noise level on the Bridge also distracts from effective Bridge Resource Management.

MDA Exercise

A Maritime Domain Awareness (MDA) exercise was conducted on Sea Fighter that involved acquiring, tracking, classifying, and reporting all encountered targets. Every 30 minutes, the Sea Fighter provided an "Alpha report" to Sector Los Angeles. This report contained ship's position, course and speed, quantity of contacts detected, and quantity of contacts classified in the preceding 30 minutes. The MDA exercise was considered successful and all contacts were effectively classified using the Sperry ARPA radar and AIS.

Flight Operations

When flight operations are announced by the Bridge, one Landing Signals Enlisted (LSE), two chock and chain men, and three hot suit men report to the flight deck. Other personnel involved in flight operations include the Helicopter Control Officer (HCO) in the Tower above the Bridge, and two ready boat crew (coxswain and engineer) who muster on the Mess Deck. Additional personnel are available to launch the small boat and assist in refueling the helicopter if needed.

The HCO communicates with the helicopter via radio. The pilots remarked that the pitch and roll of the ship communicated to them by Sea Fighter appeared to be significantly lower than actual pitch and roll.

Refueling an HH-65 helicopter on Sea Fighter takes approximately 10 minutes to transfer 160 gallons of JP-5 fuel. The AVGAS refueling station is conveniently located on the flight deck. The refueling hatch is heavy, and the refueling crew is careful not to be under the hatch while it is open.

The Figure illustrates the ability of Sea Fighter to accommodate two helicopters on deck simultaneously. Two HH-60 helicopters enable delivery of a full (16 person) MSRT / MSST via VI/VDEL. In addition, two helicopters facilitate multiple simultaneous boardings of targets of interest. If the Sea Fighter operates at high speeds with

helicopters on deck, rotor blade boots must be applied.

The flight deck on Sea Fighter is significantly better than most Coast Guard flight decks due to: "clean air" across the flight deck, excellent visibility of the horizon for the pilots, and an outstanding flight deck lighting system for night operations. Reduced eddies caused by ship superstructures, full visibility of the horizon, and the new flight deck lighting system improve the pilots ability to quickly land on the flight deck. The improvements could expand the operating window for flight operations. At a minimum, flight deck safety is improved based on the observations from the pilots. The pilots reported that the lighting system on Sea Fighter was the best they had encountered on any vessel. The size of the flight deck is remarkable, and even with one helicopter on the forward spot, the second helicopter pilot felt there was a generous amount of space on which to land.

The Commanding Officer makes the decision to turn the flight deck from "red deck" to "green deck," indicating that it is safe for the helicopter to either land or take off. There was some confusion regarding when to announce "red deck," which can be declared by any crewmember. The HCO was hesitant to announce "red deck" as soon as the helicopter landed because he felt this would permit the OOD to maneuver the Sea Fighter while the chock and chain men were in the process of applying chocks and chains.

The pilots remarked that it would have been helpful for stern approaches if the landing spots were marked with a white fore and aft lineup stripe on both landing spots.

Current Sea Fighter design does not provide a hangar; however, there is excellent fresh water wash down and AVGAS refueling capacity. Lack of a hangar is offset by the fresh water wash down capability. The helicopter support kit (HSK) can easily be stored on the Mission Deck and the elevator can be used to transport maintenance equipment from the Mission Deck to the flight deck. Future designs could accommodate a flight deck hangar or possibly include an elevator capable of lifting a helicopter from the Mission Deck to the flight deck.

Main Space Fire Drill

A main space fire drill involved a fire in the port main diesel engine room (MDE). Ten crewmembers were assembled in the Mission Deck within six minutes of sounding the alarm. The firefighting party dressed out appropriately for their roles. Ventilation was properly secured, and investigators went fore and aft of the port main diesel engine room space checking for heat. Two hose teams were manned – one with water, one with aqueous film forming foam (AFFF). A hose team entered the port MDE space with a hose (water) and contained the fire. It is unknown if the CO_2 system was used to extinguish the fire. If the CO_2 system had been used, the hose team entered the space without oxygen breathing apparatuses (OBAs).

Based on observing the drill, it was apparent that the crew does not perform main space fire drills frequently. It is unknown if the fire was Class A or Class B. Class B fires are more common in machinery spaces, and Class A fires are more common in accommodation spaces. The appropriate agent for a Class B fire is either CO_2 or AFFF. The hose team that entered the space was prepared to apply the firefighting agent (water) appropriate for a Class A fire.

The firefighting team was enthusiastic and took the drill seriously. There was no debrief or critique of the drill that was designed to improve performance in future drills.

During the fire drill, the EOOW handled all communications along with shutting down systems. The rest of the Bridge Team appeared as if they had no role in the exercise. The Bridge Team should have been handling external communications, coming to the best heading and speed for firefighting (minimize smoke infiltration, reduce relative wind, etc.), determining closest port of refuge, contacting any vessels in the vicinity with the ability to assist, and preparing for evacuation of the vessel if needed.

Law Enforcement Exercise

The scenario for the law enforcement exercise involved receipt of intelligence of a high-speed (go-fast) target leaving the port of Los Angeles. There was some tracking information that showed the target south of Catalina Island. The Sea Fighter had operational control of the CGC *Halibut*, and the Alameda County Sheriff's boat played the role of the high-speed go-fast target that tried to evade detection and interception. Air assets were not used, and since the Sea Fighter's RHIB was not functional, the *Halibut*'s RHIB was used to board the target as illustrated in the Figure.

The Sea Fighter pursued the target in autopilot, including the interception phase. While the target was attempting to evade, the Sea Fighter used the autopilot to turn the vessel. Eventually the Sea Fighter shifted to manual steering. Sea Fighter would have intercepted the target more quickly if they had shifted to manual steering earlier.

Another law enforcement exercise was planned that involved an air asset (HH-65) under Sea Fighter control, CGC *Halibut* playing the role of a drug-running mothership with associated go-fast small boats, and the Alameda County Sheriff's boat playing the role of a legitimate fishing vessel. The helicopter never launched, the Alameda County Sheriff's boat had to return to base due to low fuel, and Sea Fighter was very busy with contacts, so this exercise was cancelled.

SAR Exercise

The scenario for the Search and Rescue (SAR) exercise involved a vessel on fire that resulted in a person in the water (PIW). The Sea Fighter was supposed to respond to the mayday call and use local assets to find and recover the PIW. CGC *Halibut* and an HH-65 helicopter were the local assets available to assist Sea Fighter.

During this exercise as well as others, it was apparent that VHF communications is occasionally an issue on Sea Fighter. The Alameda County Sheriff's boat could sometimes receive and

transmit traffic on Channel 16 that Sea Fighter, in close proximity to the Sheriff's boat, could not receive. The morning of the exercise, Sector Los Angeles had to relay comms traffic from Sea Fighter to the Sheriff's boat. The Sea Fighter attributed this problem to "atmospherics."

AMIO Exercise

The AMIO exercise scenario involved the Alameda County Sheriff's boat transferring "migrants" to the Sea Fighter using their RHIB. Because only one migrant was transferred onboard Sea Fighter, four non-Sea Fighter ship riders played the role of additional migrants. The garage doors (currently inoperative) would be needed to help contain the migrants on the Mission Deck.

The migrants were brought onboard through the port side door on the Mission Deck via a Jacob's ladder rigged through the side door. The current hull configuration and accommodation system (Jacob's Ladder) does not provide for the safe and efficient transfer of personnel from / to Sea Fighter from small surface vessels. This can negatively impact several missions that rely on the ability to transfer personnel from small surface vessels (i.e. AMIO, SAR). A future design can easily eliminate this shortcoming.

MSST Operations

Three different operations were conducted with the MSSTs.

- The MSSTs 25-foot RBS SAFE Boats ran a grid pattern at different speeds to assess the ability of the Sea Fighter to track and train their weapons on the boats.
- The MSST's SAFE boats transferred three personnel to the Sea Fighter, and Sea Fighter transferred one person to one of the SAFE boats.
- An HH-60 transferred the MSST via vertical insertion (VI) onto the Sea Fighter's flight deck. The Sea Fighter was evaluated as a staging platform for an MSST.

The Sea Fighter was easily able to track and train their 50 caliber machine guns on the SAFE boat even as Sea Fighter approached 50 knots. The ability to track and train weapons on a targets of interest while operating at high speeds enhances the capability of Sea Fighter to carry out law enforcement missions such as Counterdrug and Combating Maritime Terrorism.

The transfer of personnel via the Sea Fighter's Jacob's ladder again demonstrated that this is a dangerous method of personnel transfer.

Vertical Insertion of the MSST onto Sea Fighter was accomplished without difficulty. The MSST remarked that moving about the Sea Fighter with all of their gear was especially easy compared to other Coast Guard cutters due to the generous width of the passageways and ladders

as well as the elevator. Since 16 men are deployed on a target vessel using VI, two HH-60 helicopters are needed since only 8 men and their gear can be carried in a single HH-60.

The Sea Fighter is a viable platform to deploy a MSST, since it is capable of intercepting a target with its superior speed and it can deploy the MSST via VI from its embarked helicopter(s) or via the 11m RHIB. The Sea Fighter's Mission Deck is an excellent location for stowing their gear which is normally carried in the towable trailer shown in the Figure.

Sea Fighters capabilities significantly improves Combating Maritime Terrorism mission effectiveness. The high speed capability (50kts) permits the vessel to rapidly intercept targets of interest. Multiple deployable asset capability (two HH-60s and two 11m RHIBs) permit an entire MSRT or MSST to rapidly board a target of interest. Modularity permits the MSRT or MSST to deploy with their entire pre-outfitted modules, and to use the Mission Deck for pre-staging / pre-briefs before the boardings.

D.4 Summary of Issues from Surveys, Interviews and Observations

A summary of the issues described in detail above that impact operations and mission effectiveness as well as ship design considerations in the event the Coast Guard decides to acquire a Sea Fighter-like vessel in the future are listed in Table D-4. The issues are organized by the unique feature of Sea Fighter that is impacted or future ship design considerations.

Table D-4: Summary of Issues from Crew Insights

Issues that Impact Operations and Mission Effectiveness	Comments
High Speed	
The MTU RCS-5 helm control system is very effective in maneuvering the vessel (steering and throttle).	The Sea Fighter is highly maneuverable, it turns tightly, stops in a very short distance and can be walked sideways during docking evolutions
The vessel is noisy at high speeds due to a combination of wind and water noise, in addition to the noise generated while operating on gas turbines.	The noise is believed to have a negative impact on crew fatigue. Hearing protection must be worn to prevent hearing damage while on the Mission Deck. This requirement could be eliminated if the isolation doors on the Mission Deck were fully operational
Ride quality is better at higher speeds than at lower speeds, for low and high period waves, independent of sea state. For medium period waves, high speed ride quality is reduced due to wave slamming on the wet deck. At high speeds in low and high period waves the vessel skims over the tops of low period waves and follows the surface for long period waves.	The ride control system (T-foils, active skegs, and interceptors) does not have a significant impact on damping roll, pitch, and heave below 15 knots due to the reduced flow over those control surfaces.
The Sea Fighter successfully demonstrated the capability to track and train its weapons on targets	The ability to track and train weapons on a targets of interest while operating at high speeds enhances the capability of Sea

Issues that Impact Operations and Mission Effectiveness	Comments
of interest while operating at high speeds.	Fighter to carry out law enforcement missions such as Counterdrug and Combating Maritime Terrorism.
Vessel motions at low speeds can impact the launch and recovery of deployable assets.	Reduced vessel motions at high speeds can permit the vessel to close on targets of interest quicker than existing or planned Coast Guard vessels.
The Sea Fighter is an excellent platform to deploy a MSRT or MSST for the Combating Maritime Terrorism mission.	The high speed capability (50kts) permits the vessel to rapidly intercept targets of interest.
Multiple Deployable Assets	
The launch and recovery of the SOLAS boat is unsafe, regardless of sea states. Man overboard recovery is performed by the 11m RHIB via the stern ramp.	By using the 11m RHIB for man overboard evolutions, the number of deployable surface assets carried by Sea Fighter would be reduced since one stern launch RHIB would have to remain in reserve in case of man overboard and flight operations
Stern ramp is poorly designed and subject to frequent breakdowns	Launch and recovery of the 11m RHIB is limited to maximum ship speed of 5 knots and is unsafe under challenging sea conditions
In order to recover the RHIB it is necessary for the RHIB to use full throttle upon engaged the ramp. This is both unsafe for the RHIB and puts excessive stress on the engine and waterjet. A missed approach (to the ramp) could result in the boat being trapped under the waterjet guards.	At speeds less than 15 kts Sea Fighter's ride quality is reduced. The steep ramp angle and launch and recovery speed both impact the critical operation of surface deployable assets which are essential for boarding target vessels.
The Sea Fighter can accommodate two helicopters on deck simultaneously	Two HH-60 helicopters enable delivery of a full (16 person) MSRT / MSST via VI/VDEL. In addition, two helicopters facilitate multiple simultaneous boardings of targets of interest.
Flight deck is significantly better than most Coast Guard flight decks due to: "clean air" across the flight deck, excellent visibility of the horizon for the pilots, and an outstanding flight deck lighting system for night operations.	Reduced eddies caused by ship superstructures, full visibility of the horizon, and the new flight deck lighting system improve the pilots ability to quickly land on the flight deck. The improvements could expand the operating window for flight operations.
Current Sea Fighter design does not provide a hangar; however, there is excellent fresh water wash down and AVGAS refueling capacity	Lack of a hangar is offset by the fresh water wash down capability. AVGAS refueling station is conveniently located on the flight deck. If the Sea Fighter operates at high speeds with helicopters on deck, rotor blade boots must be applied.
The Sea Fighter is an excellent platform to deploy a MSRT or MSST for the Combating Maritime Terrorism mission.	Multiple deployable asset capability (2 - HH-60's, and 2 – 11m RHIBs) permit an entire MSRT or MSST to rapidly board a target of interest.
The current hull configuration and accommodation system (Jacob's Ladder) does not provide for the safe and efficient transfer of personnel from / to Sea Fighter from small surface vessels.	This can negatively impact several missions that rely on the ability to transfer personnel from small surface vessels (i.e. AMIO, SAR).
Small Crew Size	
Crew size of 26 personnel is adequate for standing underway watches but significantly limits sustained underway operations	Sea Fighter's crew size is the minimal number required to operate the ship. Additional personnel must augment the existing crew in order to accomplish missions.
The Sperry Integrated Bridge and Navigation System (IBNS) provides the OOD and NOW with full control over multifunction display consoles from a seated position.	This significantly reduces the crewing requirements on the bridge and provides the OOD more immediate hands-on control of vessel operations.
The machinery spaces on Sea Fighter are unmanned. The EOW controls and monitors the	EOWs would prefer to stand their watch in the Engineering Operating Station, which they believe would eliminate the

Issues that Impact Operations and Mission Effectiveness	Comments
main propulsion engines and all auxiliary machinery from the Engineer's watchstation on the Bridge.	need for the Rover watch (thus reducing the number of underway watchstanders from 4 to 3). An alternative is to keep the EOWs watch location on the Bridge but allow the EOW to make routine rounds (as opposed to using the rover for routine rounds).
Modularity	
The Sea Fighter is an excellent platform to deploy a MSRT or MSST for the Combating Maritime Terrorism mission.	Modularity permits the MSRT or MSST to deploy with their entire pre-outfitted modules, and to use the Mission Deck for pre-staging / pre-briefs before the boardings.
The X-Y crane is a vital to Mission Deck operations. However it was not designed for shipboard use and cannot be used underway.	The crane is required to relocate payloads (which include deployable surface assets) on the Mission Deck. Without this capability, Sea Fighter can only launch and recover one 11m RHIB (or 7m RHIB).
The isolation roll up doors on the Mission Deck are routinely inoperable which limits the use of the Mission Deck underway.	The Mission Deck provides an outstanding containment area for holding detainees, for specialty teams to layout equipment and prep for boardings, and to prep additional deployable surface assets. However, none of this is safe and practical without fully operational isolation doors
The elevator from the flight deck to the Mission Deck is not flush with the Mission Deck when fully lowered.	The elevator platform being 1.5 feet above the Mission Deck makes it very difficult to move material on and off the elevator platform. Compounding this problem is the fact that the X-Y crane cannot be used while the vessel is underway.
The Mission Deck can accommodate up to twelve ISO Containers (20' x 8' x 8').	Coast Guard vessels currently do not require modular mission capabilities since they are designed to be multi-mission capable. However there is an increased emphasis on combating maritime terrorism using specialty teams (MSRTs and MSSTs). The MSRTs and MSSTs are being outfitted with deployable modules to accommodate their equipment.
Future Design Considerations	
The Sea Fighter is an excellent platform to deploy a MSRT or MSST for the Combating Maritime Terrorism mission.	The wide passageways and ladders and the elevator enable the MSRTs and MSSTs to easily move about the ship with full gear.
CIC is not functioning, and there is no radar repeater in CIC	
The Bridge on Sea Fighter is installed on the port side forward, which limits visibility close aboard on the starboard side and aft.	
There is no comms gear installed on the SOLAS boat	
• Sea Fighter has problems receiving VHF communications and, as delivered, was limited to line-of-sight communications • Crypto-comms equipment is located in the two hulls; it is inconvenient and time-consuming to access this equipment. In heavy weather, this equipment is not accessible • The KU band satellite communications equipment is currently inoperable	Communications problems adversely affect the ability of Sea Fighter to be fully interoperable with Navy and OGA assets
The ship is not equipped with duplex sea strainers	If the strainers clog with seaweed, all propulsion engines in the affected hull have to be shut down to permit cleaning the strainer.
The Sea Fighter is not equipped with a lube oil or fuel oil purifier	The fuel filters serving the main diesel engines, gas turbines, and ship service generators have to be replaced frequently

Issues that Impact Operations and Mission Effectiveness	Comments
	which is costly and time consuming
The consensus of the crew is that the Sea Fighter needs a second permanently assigned cook	A second cook has to be assigned TAD for underway periods.
Three person staterooms are well liked, but the consensus is that the rooms, lockers, and vertical separation between bunks are too small	The small lockers prevent the crew from carrying all of the uniforms they would need for a patrol.
• The Galley is adequately sized and equipped for a 26-person crew; however, it lacks hot wells and a milk dispenser, and the refrigerator is too small • The dining area on the mess deck is carpeted • Dry Stores consist of three open shelves	The crew would prefer to a non-carpet deck covering which would be easier to keep sanitary. Lack of storage capacity affects the duration of a patrol
There is no Head readily available to Bridge watchstanders	A watch relief is needed if a watchstander needs to use the head
There is a common desire for additional accommodation space that would permit officers and chiefs to have lounge/recreational space separate from the crew	Lack of places for the crew to go off watch adversely affects crew morale.
In order to throw a heaving line for #1 line to linehandlers on the pier, a crewman must go outside through the centerline bow hatch and walk along the narrow bow catwalk to the pier side of the ship and throw the heaving line that has been tied to #1 line and led through the bow chock to another crewman standing in the vertical opening of the fo'c'sle.	Sending a crewman outside the ship onto the bow catwalk is considered unsafe by the crew.
At night, several displays and monitors on the Bridge have to be covered with towels because they are bright and cannot be dimmed. The generally high noise level on the Bridge also distracts from effective Bridge Resource Management.	High noise levels on the Bridge are attributed to: • Two air conditioning units installed on the Bridge • Movement of the chairs for the OOD, CO, NOW and EOW • Off-watch crew members who congregate on the Bridge • Verbal communications associated with break-in Bridge watchstanders
The pilots remarked that it would have been helpful for stern approaches if the landing spots were marked with a white fore and aft lineup stripe on both landing spots.	
Current Sea Fighter design does not provide a hangar.	Future designs could accommodate a flight deck hangar or possibly include an elevator capable of lifting a helicopter from the Mission Deck to the flight deck.

D.5 Crew Interview Questionnaire

SEA FIGHTER CREW INTERVIEWS

Introduction:

The Coast Guard is evaluating this type of vessel for potential future use. We have some underway time on her to evaluate her capabilities, and we are doing some computer simulations to further evaluate her. However, we believe it is extremely important to get the impressions and opinions of those of you that have lived aboard her, taken care of her, and sailed her. We really do value and need your candid thoughts. Should the Coast Guard decide to acquire vessels like Sea Fighter in the future, we must design and build the vessels right. The way to increase that probability is to tap the knowledge you have obtained sailing onboard her.

Introduction/Background:

Date:

Name:

Experience:

Years in Service:

Seagoing Time:

Vessels Served On (& Duties):

Time Onboard Sea Fighter:

Duties:

Guiding Questions

GQ1: Primary duties focus questions:

- **Surface – Bridge**
  - What specific duties do you perform on the bridge?
  - How efficient is the bridge layout for most U/W operations? Explain.
  - How would you rate the visibility from the bridge? Explain.
  - For Helmsmen / OODs:
    - How responsive is the helm? Explain.
    - How maneuverable is Sea Fighter in mooring/docking? Explain
    - Does vessel speed, seas, or wind impact her responsiveness?
    - Is the Sea Fighter operated routinely on auto pilot?
  - For Navigators / OODs– How efficient is the layout of the bridge's navigation equipment? Explain.

  - For Radar Operators / OODs (Bridge repeater) – How efficient is the layout for the bridge radar repeater? Explain.

- **Surface – CIC**
  - How efficient is the location of CIC relative to the bridge? Explain.
  - How efficient is the layout of CIC? Discuss size, equipment layout, troubleshooting equipment, and comms with the bridge.

- **Surface – Deck**
  - How efficient is the layout for lines, fenders, etc.? Explain.
  - How easy is it to hear commands from the bridge at your mooring station?
  - How efficient and safe is it for docking and mooring evolutions (i.e., throwing heaving lines, passing / recovering mooring lines, etc.)? Explain. (Probe about prepping for docking while underway due to spray and exhaust fumes.)
  - How would you rate small boat launch and recovery from an efficiency standpoint? Explain.
  - How would you rate small boat launch and recovery from a safety standpoint? Explain.
  - Have you ever anchored? If yes, how would you rate that evolution? Explain.
  - Have you ever performed an UNREP (for fuel, supplies, ammo)? If yes, how would you rate UNREP on Sea Fighter? Explain.
  - For flight quarters, have you practiced for flight ops? If yes, how would you rate flight ops (from the ship perspective)? Explain.
  - How easy is it to bring supplies and consumables onboard? Explain.

- **Surface – Subsistence**
  - How is the galley layout? Explain. What needs to be changed if you needed to feed a crew of 100? How would you feed 200+ migrants onboard for greater than 12 hours?
  - How is the mess deck layout? Explain.
  - How is the overall flow from dry stores, freezers, the galley, and the mess deck? Explain.
  - How do you stow the garbage collected underway? If you were underway for a week to 10 days would the quantity of garbage on board become a problem?

- **Surface – Medical**
  - How would you rate the sick bay location on the ship? Explain.
  - How is the size of sick bay? Explain.
  - How efficient is the layout of sick bay? Explain.
  - Is there a good match between the available medical equipment onboard, the medical training received by the corpsmen, and the needs of the crew for medical support?

- **Engineering – Main Propulsion**
  - How efficient is the bridge to engine room layout? Explain.
  - How efficient is the bridge layout for the EOW? Explain
  - Should the EOW be in the bridge? If not, where should the EOW be located? Why?
  - How efficient is the engine room layout for physical checks and PM work? Explain.

- How easy is it to perform major overhaul on Main Prop equipment? Explain.
- Are the spare parts needed to perform corrective and preventive maintenance available, well organized, inventoried, and easily obtained?

- **Engineering – Damage Control**
  - Where are the locations of the DC lockers?
  - How efficient is the location of the DC lockers? Explain.
  - Are the DC lockers equipped with the appropriate equipment?

- **Engineering – Auxiliary**
  - How easy is it to refuel in port? Explain.
  - How easy is it to replenish lube oils, hydraulic fluid, etc., in port?
  - Are the spare parts needed to perform corrective and preventive maintenance available, well organized, inventoried, and easily obtained?

GQ2: How is the habitability onboard?

- What is your opinion of the berthing on Sea Fighter? Why?
- Give me your impressions of the mess deck and galley? Why?
- Are there adequate heads and facilities in the heads? Why?
- Give me your impressions of crew rec areas? Why
- Can Sea Fighter accommodate mixed-gender crews?
- What changes would you recommend from a habitability perspective for a Sea Fighter-like vessel that is placed in the fleet?

GQ3: Ride Quality / Speed:

- Give me your impression of how she rides at 50 knots? Explain.
- Give me your impression of how she rides at 15 knots? Explain
- Give me your impression of how she rides at 5 to 10 knots? Explain
- Give me your impression of how she rides while drifting? Explain
- Does the ride quality impact you executing your duties? Explain.

GQ4: Payload Flexibility:

- How beneficial is the payload flexibility? Explain.
- How easy would it be to onload and offload equipment / modules from / to the payload deck? Explain.
- Do you think using modules (berthing, mess deck, OpCen, etc.) is preferred over building out portions of the payload deck?

GQ5: Safety:

- From your perspective, how safe is the launch and recovery of the RHIBs? Explain.
- From your perspective, how safe is the launch and recovery of the SOLAS boat? Explain.
- From your perspective, how safe is the Sea Fighter overall? Explain.

GQ6: Future Design:

- How do you like the design and overall layout of Sea Fighter? Explain.
- What things need to be incorporated into a new Sea Fighter-like vessel that may enter the operational fleet?
  - What things should be considered for the crew and vessel in order to sustain a 21+ day underway patrol without replenishment?

GQ7: Manning / Preventative Maintenance:

- With minimal manning, there are no non-rates in the Sea Fighter crew. Is this a problem for the assigned E-4s who may be required to perform duties usually assigned to non-rates?
- Are there procedures in place to ensure the equipment is maintained (both preventive and corrective) with this minimal manning concept?

GQ8: Flight Operations:

- **Crew:** How would you rate the flight deck for ease of flight operations (Extremely efficient and optimal for flight ops – to very difficult and bordering on unsafe)? Explain.
- **Crew and AirSta:** How would you hangar deployed aircraft on a future design? For example would you place the hangar forward taking the place of the forward spot for the second helo, or would you use the mission bay as a hangar with an appropriate elevator to raise and lower the helo?
- **AirSta:** How do you prefer to approach Sea Fighter when landing a helo (angle, speed of the vessel, etc.)?
- **AirSta:** How safe and efficient is the refueling setup for helicopters on Sea Fighter?
- **AirSta:** Compare Sea Fighter's flight deck to flight decks on other Coast Guard Cutters for ease of operations, including takeoff and landing. Is the Sea Fighter's 6-person flight deck crew, which consists of 1 LSO, 2 hot suit men, and 3 chock-and-chain men, adequate; or is a fully manned and ready firefighting crew desired/preferred?
- **AirSta:** What is the standard deployment package for a helicopter on a cutter (crew, supplies, etc)? Would that package be modified for two helicopters deployed on the same cutter? If yes, how much additional crew, supplies, equipment, etc.?
- **AirSta:** How do you feel about flight operations with two helicopters on deck? Would you take off with another helicopter forward? Would you take off with another helicopter aft? Would you land aft with another helicopter forward? Would you land forward with a helicopter aft? How would you like the helicopter on the flight deck (forward position) to be positioned when not in use to optimize use of the flight deck?

GQX: MSST Operations:

- **Sector Commander:** As part of the Combating Maritime Terrorism (CMT) mission, there is a mandate to interdict terrorists and vessels containing weapons of mass destruction as far from the home shores as possible. In the transfer scenario there may be a need to use an MSRT or MSST to interdict. Do you see a benefit in the use of a Sea Fighter-type vessel over other Coast Guard assets to interdict vessels in this scenario? If yes, why?
- **MSST:** What are the benefits and disadvantages of the Sea Fighter as a deployment platform for an MSST? How does it compare with deployment from other Coast Guard surface assets, such as a 378' WHEC or an NSC? Are there benefits to the MSST to use a Sea Fighter-type vessel for boardings of suspect vessels (by 11m RHIB or vertical insertion) in the Domestic Zone (ports and internal waters), in the Border/Coastal Zone (EEZ and Territorial Seas), and in the International Zone (High Seas)?
- **MSST:** What are the benefits and disadvantages to the use of the 11m RHIB, along with the launch and recovery of the RHIB using the stern ramp? How does use of the stern ramp compare with deployment from other Coast Guard surface assts?
- **MSST:** How easy is it to make an approach on and board Sea Fighter using SAFE boats and with Sea Fighter operating at various speeds (DIW, 10 knots, 20+ knots)?
- Is the Sea Fighter mission bay adequate for staging the gear the MSSTs must bring aboard? Is it adequate for conducting briefings? How convenient is it to transport your gear and stage it on the flight deck? Is the elevator useful for transporting your gear?
- If there was a counterterrorism threat in a go-fast vessel and your MSST is deployed on Sea Fighter, how would you propose to proceed? For example, would you prefer to see the use of force from a deployed helo? Use the 11m RHIB, or respond with the Sea Fighter itself?

D.6 Crew Interview Notes (interviewees names redacted)

Sea Fighter face-to-face crew interviews were conducted 24–26 April 2006 and 22–24 May 2006 onboard Sea Fighter while the ship was in homeport San Diego, CA. Craig Schnappinger led the interview team, Mike Sprague recorded the notes of the interviews, and Phil Muir observed the interviews and ensured a consistent approach was used. A list of guiding questions was prepared in advance and used to ensure a consistent set of questions was asked of each crewmember. All crewmembers were interviewed except one Enlisted, USCG, and one Enlisted, USN, who were not available. A telephone interview was conducted with the XO, Officer, USCG, just prior to his departure from the ship for his new duty station as CO, CGC *Padre*. The schedule of interviews conducted is shown in Table D-5.

Table D-5: Sea Fighter Crew Interview Schedule

Name	Date	Time
Officer, USCG	15 June 2006*	1015-1120
Officer, USCG	25 April 2006	1705-1910
Enlisted, USCG	24 May 2006	0840-0910
Enlisted, USCG	24 April 2006	1610-1730
Enlisted, USCG	24 May 2006	1030-1125
Enlisted, USCG	24 May 2006	0915-0955
Enlisted, USCG	23 May 2006	1510-1545
Enlisted, USCG	23 May 2006	1430-1510
Enlisted, USCG	N/A	N/A
Enlisted, USCG	24 April 2006	1445-1530
Officer, USN	24 May 2006	1230-1400
Officer, USN	22 May 2006	1620-1715
Officer, USN	23 May 2006	1555-1625
Officer, USN	24 May 2006	1135-1220
Enlisted, USN	25 April 2006	1240-1330
Enlisted, USN	26 April 2006	1320-1500
Enlisted, USN	26 April 2006	1605-1700
Enlisted, USN	N/A	N/A
Enlisted, USN	25 April 2006	1355-1500
Enlisted, USN	26 April 2006	1510-1550
Enlisted, USN	26 April 2006	1225-1300
Enlisted, USN	25 April 2006	1520-1640
Enlisted, USN	22 May 2006	1725-1750
Enlisted, USN	24 April 2006	1535-1605
Enlisted, USN	22 May 2006	1525-1615

* *Telephone Interview*

The notes of each interview in the order shown in Table D-5 are contained in the following sections of this report.

D.6.1 Interview of Officer, USCG

Background

Officer, USCG, has orders to attend PCO/PXO school en route his new assignment as Commanding Officer, CGC *Padre*, a 123' Island Class Patrol Boat, Key West, FL. Officer, USCG, is a plank owner and was the XO under the first CO, LCDR Bryan, and under the new CO, LCDR Nunamaker. LT Saunders, USN, has relieved Officer, USCG, as XO. Officer, USCG, will depart the ship on 16 June 2006, when the Sea Fighter is scheduled to depart for Hawaii to participate in RIMPAC. LT Saunders was the former officer in charge of the Maintenance Support Team that was created to support Sea Fighter.

Duties

The XO stands underway OOD watches and assists the OOD or the HCO during flight operations.

Bridge Layout

The Bridge layout is very efficient. Visibility is great except for mooring. Cameras are used to help the OOD moor the ship. However, the placement of the after cameras in the main gas turbine exhaust stream causes them to melt.

The OOD acts as the helmsman (similar to WPB operations) because at high speeds there is not enough time to give rudder and stick commands. On Sea Fighter, the OOD has the deck and the con. An additional qualified OOD is needed to assist when the ship is conducting Coast Guard operations.

The helm is very responsive, but when the ship is operating in excess of 30 knots, or in following seas, the autopilot is better able to control the ship (minimize yawing) than manual steering. It is necessary to switch to manual steering when pursuing evasive targets.

The NOW sits next to the OOD and, as a result of a recent change in standard operating procedures, deals with contacts only. The 3000 Transit series on the 87' CPB is better (more user-friendly) than the Sperry ECDIS system on Sea Fighter.

The EOW stands his watch on the Bridge opposed to the EOS. This is preferred because the EOW provides another set of eyes to help the OOD, and it facilitates rapid and effective communications with the OOD. The Rover watch is not needed; the EOW should be permitted to leave the Bridge for short periods, and the OOD can monitor the machinery plant from the OOD’s console while the EOW is away from the Bridge. In the event of special evolutions, the assistance of another EOW is needed on the Bridge.

CIC/Comms Link

Currently inoperative. This link is needed for Battle Group operations due to the redundancy requirements. However, for Coast Guard operations or single-ship operations, a single TAO on the Bridge is more than enough to handle the comms requirements.

Mooring

The procedure used to throw a heaving line for #1 line is problematic because it requires a person to go outside the ship on the bow catwalk while the vessel is underway prior to approaching the pier. Communications with linehandlers is also problematic due to the poor Hose McCann telephone system. The mooring lines are not visible from the Bridge. If the OOD goes out onto the Flight Deck, he can see the mooring lines but he then loses the ability to transmit line commands. The current CO tries to give line commands similar to other Navy ships. The XO believes the CO should be a safety observer and the OOD should be giving commands to the linehandlers. Kevlar mooring lines save weight but make the mooring bitts the weak link in the chain.

Normally, the Sea Fighter ties up port side to the pier to permit direct access to the Mission Bay from the pier through the Mission Bay port side door. If the vessel ties up starboard side to the pier, a crane is used to set the gangway on the Flight Deck to a stair tower. Small stores are brought into the Mission Bay via the port side door and transported to the final storage location. Loading stores when the ship is starboard side to the pier requires extra handling, as the stores must be placed on the elevator on the Flight Deck, lowered to the Mission Bay, and then transported to the final storage location.

Small Boat Operations

Launch and recovery of the SOLAS boat is a dangerous operation and is reserved as a last-ditch lifesaving use only. It is not used for man overboard. The SOLAS boat launch system needs to be redesigned for automated launch. Launch of the 11 meter RHIB via the stern ramp is limited to 5 knots. The XO is currently trying to convince the CO to recover the RHIB at 7 knots. This speed would facilitate avoiding the waterjet guards in the event of a missed approach. The CO may approve this higher speed for recovering the RHIB.

The launch and recovery of the RHIB on Sea Fighter is based on the Coast Guard 87' CPB procedures. The recovery procedure puts unusual strain on the cast aluminum waterjet on the 11m RHIB.

The XO does not think the stern ramp’s 17-degree down angle is too steep. However, because of the steep angle, the Sea Fighter cannot put a man on the ramp to throw a line to the RHIB as it comes up the ramp, similar to the procedure used on an 87' CPB and 123' WPB. The procedure on Sea Fighter calls for the boat crew to lasso the crucifix as the boat comes up the ramp. The XO prefers the 87' CPB procedure because, at night, it is difficult for the boat crew to lasso the crucifix.

Underway Refueling

The Sea Fighter has refueled underway two times. The procedure used is for the refueling vessel to tow the Sea Fighter and stream the refueling hose aft to Sea Fighter. This does not require the Sea Fighter to take station on the refueling vessel and constantly adjust speed.

Flight Operations

The XO believes the talon grid should be used to eliminate chocks and chains and thus improve safety. Currently the helos have to be chocked and chained. This requires the chock-and-chain

men to approach the helicopter with both hands full (chocks in one hand and chains in the other). The Sea Fighter is equipped with a Flight Deck AFFF flooding system; this allows more time to respond with a firefighting team if needed.

Currently, 210' WMECs stay on patrol for two weeks with a helo and no hangar. There is a freshwater washdown system available on Sea Fighter. Would it be better to sacrifice the second helo pad in favor of a hangar, or should the elevator be designed to accommodate a helicopter? Elevator solution is a good idea, but it would require folding the blades and we would lose the ability to move mission modules in the Mission Bay. The hangar solution represents a weight gain, loss of visibility, and the loss of one landing spot. Of the two, the elevator solution appears to be better.

Refueling a helicopter appears to be comfortable and safe. The proper way of opening the refueling pit hatch is to push it up from below opposed to raising it from the Flight Deck.

Habitability

The Galley is adequate, but the ship needs an extra cook. The Mess Deck is adequate, but the television should be shut off. The Crew's Lounge is good, although it tends to get crowded. The Crew's Lounge and the Mess Deck are the only places for the crew to relax when off-watch. This crew has had to put up with shipriders and guests impinging on their spaces while underway.

There is no space for the junior officers to go; perhaps a khaki lounge should be considered for officers and chiefs in a future vessel. This ship is not a problem for 4 to 5 days. If longer patrols are contemplated, a Conex box may be used as additional lounge space.

Medical spaces (Sick Bay) are adequate. The Sea Fighter would apply first aid and quickly transport the victim via the fight deck.

Berthing areas are small but workable and bigger than similar areas on 110' WPBs and submarines. Added features such as drop-down DVD players from the bunks and the ability to sit up and read in the bunk would be beneficial. Longer patrols would require additional locker space.

Ride Quality

The Sea Fighter ride quality at 50 knots is good. In 10-foot following seas, the Sea Fighter would have to slow down to less than 30 knots, but the ride quality is still good. In 10-foot head seas, the Sea Fighter would have to slow down to less than 30 knots and the ride quality would not be good. In 4- to 6-foot seas, the Sea Fighter could go faster and the ride quality would improve. Loitering in 10-foot seas, the ride quality is terrible.

Noise Levels

At 40 knots, noise is remarkable due to water noise over the hulls and due to engine noise. Carpeting deadens the noise a little, but the basic problem is due to the aluminum construction.

Modular Payloads

Mission modules add flexibility. If 50 to 100 migrants were to be onboard as a result of an AMIO patrol, where would you put them and how would you accommodate them? Migrants would be contained aft in the Mission Bay forward of the forward garage door, which would be closed. This location is selected because:

- If migrants see land, they want to jump overboard; there are no windows on the Mission Bay.
- The migrants could not be seen by a CNN helicopter.
- There is a head available for their use, and it would be possible to feed them on the Mission Bay.
- It would be easy to guard them, contain them, and prevent them from accessing other spaces in the ship.

Crew Size

With dedicated shoreside support, crew size would need to be approximately 31 to 32 people. One of these additional crewmembers must be a cook. The dedicated shoreside support has not been realized as envisioned. Therefore, the crew must perform PMS in port, which is not in accordance with the original staffing plan. This is a failure of the system, not a failure in the Sea Fighter crewing philosophy.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Redesign the stern ramp. The RO-RO capability is not needed.
- The MTU propulsion diesel engines should be retained.
- The Hose McCann telephone system should be replaced with a better system.
- The communications system should be upgraded and include more capability.
- Bridge wings are not needed.
- The existing Bridge was offset to port to make room for the affordable weapons system, which is no longer onboard. Placing the Bridge on the centerline is better.
- This ship was built by the lowest bidder, and there were too many contracts and subcontracts.
- Change the Flight Deck nets to the type used on the 210' WMEC.
- Stay away from the SOLAS boat.

In retrospect, the idea of a joint Navy/Coast Guard crew was a great idea. However, the Navy and the Coast Guard did not take maximum advantage of the opportunity. Too much time was spent writing procedures, doing training, and dealing with Navy regulations that were designed for conventional ships and not the Sea Fighter. The Navy and Coast Guard should have been more insistent in following the original plan. The Sea Fighter was supposed to be an experimental vessel, but the Navy tried to treat it like a conventional Navy ship. It was also supposed to be part of the LCS program; this was not the case in reality. It would have been

better to initially accomplish Navy testing, then fleet the Coast Guard XO up to CO and dedicate the ship to Coast Guard testing in the Caribbean.

The transit to Hawaii for RIMPAC is supposed to be at 14 knots. It would be better if Sea Fighter deployed 3 to 4 days behind the Battle Group and then sprinted out to overtake the Battle Group and get there ahead of them. But we will proceed with them at 14 knots.

From a Coast Guard perspective, does speed really matter? In the Northeast and Northwest, no; but in the Caribbean, yes (especially with the assistance of HITRON), to chase down and catch go-fasts being used for running drugs and smuggling migrants.

The XO thanked the R&DC for taking the initiative to interview the crew.

D.6.2 Interview of Officer, USCG

Background

The Navy threw all the requirements the first-of-a-class ship goes through onto the crew of 26 persons in Sea Fighter. Officer, USCG, was promoted to CWO2 from Chief Operations Specialist during his tour on Sea Fighter. After reporting aboard, Officer, USCG, was assigned to the operations department (admin, supply, and Galley). When Officer, USCG, departs the Sea Fighter, he will be assigned to Rescue 21 in Norfolk, VA.

Duties

- Primary duty is Communications Officer.
- After promotion to CWO, the detailer said he would keep him on Sea Fighter for a year. Therefore they created a Comms Department with Officer, USCG, as the department head. Assigned personnel originally included the ETC, IT1, ET1, and IT2. The IT1 was promoted to ITC, and just recently the ETC was promoted to ETCS. The department is responsible for electronics equipment, telephones, computers, radios, and XRM equipment. Officer, USCG, in essence became the EMO (electronics material officer).
- Breaking in as OOD. Officer, USCG, has anchored and navigated as part of breaking in as OOD. The CO, XO, and CHENG have authority to sign off qualifications as OOD, NOW, and EOW. The NOW break-in watch also has comms watch duty.
- Aft mooring station safety observer. This duty involves overseeing linehandlers and providing distances to the pier and other objects as the ship approaches or departs the pier. Comms to the after mooring station is fairly good, but the noise is an issue; the ventilation fans must be secured to enhance comms. The ship moored once on the port gas turbine due to a casualty to the port main diesel; the exhaust fumes burned a crewman's throat and he was on the binnacle list for a week.

C4I

The C4I Install was completed September 2005, but only an Interim Authority to Operate (IATO) was granted. There is an internal LAN but no connectivity for exterior comms. Support team at RSO San Diego is trying to help. The layout of the DGPS and radar equipment for the NOW watch is good. The addition of AIS is a huge help.

CIC is currently not functioning. If the gear were operational, the layout is good, except there is no ability to see the surface picture in CIC (there is no radar repeater). Voice-over IP is installed in CIC. Functionally there is a need for CIC which includes Sea Fighter's core combat system, the Mission Module Integration System (MMIS). This system was developed by Northrop Grumman specifically for Sea Fighter in her role as the LCS mitigation platform.

Crypto classified and unclassified LANS are separated and installed in both hulls to ensure redundancy.

Bridge Layout

The OOD position on the Bridge includes machinery plant monitors, radar, and VMS. Comms gear is not built in and would be a good addition. Voice-over IP headset for the OOD would be a huge improvement. The numbering system is confusing. For example, the number 2 engine room has the number 1 engine. Therefore numbers are removed when referring to the equipment (e.g., starboard engine room, port main diesel).

The autopilot is normally used to steer the ship. The autopilot provides cross-track error, which is very helpful. The ship can be turned at a slow and controlled rate using the autopilot. If the OOD wants to turn faster, the autopilot is turned off. The waterjets are not as responsive as rudders. The waterjets, however, are very effective in stopping the ship. During ABS certification, a crash stop from 50 knots was successful in stopping the ship in 330 yards.

The EOW station behind the OOD is helpful to the OOD to avoid engine abuse.

The shock-absorbing seats on the Bridge were designed for expected G-forces that have never been realized. When operating at high speeds, the Bridge windows present a problem identifying contacts because the vertical separators between the windows hide contacts. The Bridge was offset to port to permit launching UAVs off the starboard side of the Flight Deck. The NOW cannot see the starboard side of the ship very well. Cameras are cheap and not stabilized. Some of the cameras were installed in the exhaust stream of the gas turbines.

Habitability

The Galley and Mess Deck: Everybody must lend a hand to keep the Galley cleaned up. The freezer to refrigerator size is out of balance. A bigger refrigerator is needed. Need more eating space. Only 16 men can sit down on the Mess Deck. The Crew's Lounge is an authorized eating space when the Mess Deck is being used for briefings or entertainment. The wardroom was converted to a Crew's Lounge, and more comfortable chairs were installed.

Sick Bay is adequate for 26 crewmembers. If there were more crew, the number of beds in Sick Bay would have to double from one to two.

Crew berthing areas consist of three-person staterooms with three lockers. These rooms are not big enough. The Captain (submariner) who designed them visited the ship and agreed they should be larger. The Comms Officer shares a room with the CHENG. Vertical clearance between bunks is an issue. Three females were accommodated by displacing one male crewmember for one underway period.

Ride Quality

With the Ride Control System (RCS) on, 8-foot seas at 40 knots results in a nice ride. Without RCS, the ship would roll 9 to 10 degrees in the trough. The more you slow down without RCS, the worse the ride gets. In 8-foot seas at 10 knots, the ride is terrible. Loitering (or drifting), the ride depends on the sea direction and sea state. If the ship is in synch with the wave period, the ride improves. The RCS consists of T-foils under each hull forward, interceptors and active skegs aft. Interceptors act like trim tabs.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Crew size (of 26) is too small.
- Physical design of fo'c'sle is poor – unsafe in heavy weather. Put in windows to provide visibility, or open it up.
- Steel doors installed in aluminum bulkheads are a problem.
- More discussion between ship designer, boat builder, and certification authorities!
- Design the vessel with the crew in mind; take crew input seriously.
- X-Y crane was not designed to be installed in a ship.
- Crew's lounge – CO was allowed to change designation of wardroom.
- Carpeting in Mess Deck and berthing areas should be terrazzo.
- Flight Deck – Do more testing with helos; switch from 6 percent AFFF to 3 percent AFFF slowed down testing of Flight Deck on Sea Fighter. Flight Deck certification also took too much time. Hangar is needed.
- Mental strain for a small crew of 26 has been pretty intense (one crewmember's fiancée died, and one Nichols worker was killed onboard during christening.)

D.6.3 Interview of Enlisted, USCG

Background

Previous duty stations have included sea duty on board a 270' WMEC. Enlisted, USCG, will make the transit to Hawaii in June for RIMPAC; on 1 August he will depart the ship for Loran school en route to Petaluma, CA.

Duties

Underway duties include:

- NOW watch
- Break-in OOD and TAO watch
- NOW watch or linehandler for Special Sea and Anchoring Detail
- Hot Suit man for flight operations

Layout of the Bridge

The position of the NOW watch relative to the CO and OOD is good. The NOW watch station has access to the GPS and AIS radar, which is well laid out. Would prefer to see the output of the “X” band radar at the NOW watch station and the “S” band radar output at the OOD’s watch station.

The visibility for high speed rules from the NOW watch station is great. The Bridge, offset to port, allows good visibility; however contacts tend to sneak up on the stern. The FLIR on a 270' WMEC is gyro stabilized and automatically tracks targets, which is preferable to the Sea Fighter’s FLIR.

The navigation software is easy to use; however, you have to use it constantly to maintain proficiency. The Coast Guard version is more user-friendly. The autopilot is good except for following seas. Even manual steering is a problem in following seas.

The Bridge is equipped with two VHF radios as well as HF and UHF. None of these radios is a problem on Sea Fighter.

ET Duties

There is no ET shop to facilitate maintenance of the equipment. The aft camera was not waterproof and the video was lost, but we could not repair it due to warranty concerns. Now that the warranty is up, it can be repaired (the BNC connector for the zoom feature needs replacing). The starboard mezzanine deck has a cage installed for the SIPRNET equipment; this cage is blocking access to a cabinet containing electronic equipment for which the ETs are responsible to maintain.

Habitability

The Mess Deck is adequate – have never seen it full. The Crew’s Lounge needs to be bigger. As far as places to go off-watch, he has CIC and his stateroom as places he can go off-watch. Berthing areas are cramped. There is a need for more hang-up space in the lockers. If the racks

were only two high instead of three high, it would be better. The Mission Bay is huge, and the berthing spaces are tiny – doesn't seem to make any sense. Heads are adequate. Living onboard is satisfactory.

Ride Quality

At 50 knots in 4- to 6-foot seas, the ride quality is smooth. At 10 knots in 4- to 6-foot seas, the ride quality is unstable and not smooth; it is difficult to do your job. At 50 knots, accessing port and starboard secure comms is allowed, but you need to wear hearing protection.

Mooring the Sea Fighter

There is a safety supervisor and 4 to 5 people in both the after and forward mooring stations. The safety supervisor also uses a range finder to call distances to the pier and other objects close aboard to the OOD as the ship approaches or leaves the pier. Kevlar mooring lines slip on the capstan; therefore they must be pulled by hand. Fortunately, the ship is so maneuverable the OOD can even walk it sideways onto the pier. A crewman has to go outside the ship on the bow catwalk to throw the heaving line that has been attached to the #1 line to another crewman standing in the opening of the fo'c'sle near the bow. Then, as the ship nears the pier, heaving lines for both #1 and #2 lines can be thrown to linehandlers on the pier.

Flight Operations

Initially there were two Flight Deck teams (#1 and #2). Team #1 did all the drills, so Team #2 eventually disappeared. Team #1 was on the Flight Deck at one point for 10 hours fully suited up with SCBA, helmet, and mask. This was eventually changed to fully suited up except mask and helmet. Racks on the side of the Bridge are needed to stow flight operations gear. Currently everyone has their own locker for their gear scattered all over the ship.

Pilots were not concerned about the wind across the deck for a helicopter on deck. They are, however, concerned about salt water/salt air corrosion. The pilots prefer high tie-downs to chains. Even though HH-65s have composite skin that is not subject to corrosion, salt air/water can still infiltrate the engine compartment and corrode metal items. It would be better to lower the helo via elevator into the Mission Bay opposed to a hangar.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Speed of the Sea Fighter is good.
- There is plenty of room aft on the Mission Bay for migrants.
- More spacious berthing areas would be good.
- Initially when people were getting qualified, the crew was getting burned out due to 20-hour days.
- There is a need for an ET shop and 2 to 3 ETs to facilitate maintenance of the equipment.
- Need additional accommodation spaces for the crew to relax while off-watch.

D.6.4 Interview of Enlisted, USCG

Background

Has 11 years in the Coast Guard. He and his wife are natives of San Diego, CA. He was promised San Diego as his next duty station; however, he has received orders to PACAREA training team. He does not believe his detailer is responsive. He is supposed to transfer 1 August, but extension is probable due to RIMPAC. His wife will not transfer with him, so he is considering getting out of the Coast Guard.

Duties

- Underway:
  - Enlisted, USCG, and the XO are the only qualified coxswains of the 11m RHIB
  - OOD watch
  - Boarding Officer
  - Operate and maintain: X-Y crane, SOLAS boat, davits, side door, rolling doors
  - Special sea and anchor detail: Aft mooring deck to handle # 3 and # 4 lines
- In Port:
  - CDO
  - Boarding Officer
  - Operate and maintain: X-Y crane, SOLAS boat, davits, side door, rolling doors

Sea Fighter Equipment

Data display on Bridge at 50 knots is “not bad” in 10-foot seas or less. In calm sea conditions, it’s great. Lots of problems with Sea Fighter equipment/systems, especially the electronic equipment. Sensor defects are common; for example, “high temp alarm” in freezer is not a problem with the freezer, it’s a problem with the sensor. VMS crashes all the time. Many of the systems and equipment on Sea Fighter are manufactured in Germany, Poland, and 3 to 5 other European countries, making it very difficult to obtain spare parts in a timely manner.

The X-Y crane has two speeds, slow and slower. The X-Y crane does not work most of the time due to various mechanical issues, and you can’t use it at all underway. The crew will not walk under the X-Y crane due to fear that it may collapse. Combined with the slow elevator, it takes approximately 30 minutes to rig and transport cargo from the Flight Deck to a new position in the Mission Bay.

The rolling garage doors are inoperative because of the aluminum ship racks in a seaway, causing the doors to pop out of their tracks.

Autopilot is normal means of steering the vessel, both in diesel mode and on turbines during high-speed operations. However, the autopilot is not good in quartering seas – it zigzags. Manual steering with the T-handles is tricky. The Sea Fighter is highly maneuverable – it can turn and stop on a dime, and it is easy to walk the ship sideways.

It is not possible to navigate on paper in rough sea conditions. The Sperry ECDIS system is used on Sea Fighter; however, the system used in the high-speed simulator in Norfolk, VA, is better and more user-friendly than the Sperry system.

Sea Fighter is very noisy. Part of the problem is that the “lowest bidder” who built the ship did not fully weld everything, which creates a “hum” that is similar to the noise created by blowing on a blade of grass held between your fingers.

Mooring

There are two mooring stations: aft and forward (fo’c’sle). There are two boatswains mates on board; one is assigned to the forward mooring station for Special Sea and Anchor Detail, and the other is assigned to the aft mooring station. The aft mooring station deals with # 3 and # 4 lines. Getting # 4 over is challenging. A crewmember has to go up to the SOLAS boat deck and drop a heaving line (stanchion is in the way). In addition, the exhaust from the propulsion diesels and gas turbines (if running) frequently get blown back into the ship and sucked into the ventilation system. If the junior officers who drive the ship did a better job, it would be helpful. The lines are Kevlar and cannot be put to the winch; therefore, they must be hauled in by hand. Communicating with the internal communicators is also difficult due to the extremely loud ambient noise levels in the aft mooring station.

Exhaust fumes get sucked into the ventilation system when the ship is going slowly, as in mooring evolutions.

Ride Quality

At 50 knots in 10-foot seas, the ride quality is dependent on sea direction and period. At 40 knots in 10-foot seas, the ride is smooth; however, the ride deteriorates as the vessel slows. At slow speeds in 10-foot seas, the ship pitches and the roll is jerky, and seasickness becomes an issue. When the ship is going slow or loitering in higher sea states, it is difficult to move about the ship due to the unpredictable nature of the roll and pitch.

The ride control system works 90 percent of the time. There are two T-foils forward, one under each hull; active skegs and interceptors aft.

Weight distribution in the Mission Bay is compensated by shifting fuel to obtain the proper trim. In general, it is desirable to place heavier items aft.

Boat Operations

During rough water trials in April 2006, a buoy was thrown overboard and the 11m RHIB was launched in 8-foot seas to retrieve it. It took three different course changes to find the sweet spot to recover the RHIB. When the seas are greater than 5 to 6 feet, the stern ramp emerges from the water periodically, making recovery especially challenging. Recovering the boat in 8-foot seas is borderline safe and should be considered the maximum allowable for recovery operations. The stern ramp design on Sea Fighter is terrible. The design of the stern ramp on the LCS is better. The Sea Fighter stern ramp is supposed to be designed for launch and recovery up to 15 knots. In reality, the maximum speed of Sea Fighter is 5 knots for L&R of the RHIB. The boat plug must be left out while the 11m RHIB is on the cradle because in high-speed operations, the rooster tail causes water to enter the boat.

SOLAS boat launch and recovery operations were dangerous. Now, after a few changes, it is safer. For example, a cleat was welded on the Mission Bay deck to tie off a sea painter for the SOLAS boat. Supposedly the SOLAS boat can accommodate 600 lbs or 6 people, but in reality it is unsafe to put 6 people in the SOLAS boat. The Sea Fighter has to declutch and secure the port main diesel engine for launch and recovery of the SOLAS boat. If a real man overboard occurred, he would choose to launch the RHIB opposed to the SOLAS boat.

Habitability

Berthing areas are too small. Three-man staterooms are nice, but they are way too small. The heads are adequate. An officer designed the Mess Deck, which is cramped. The wardroom originally designed into Sea Fighter was converted to a Crew's Lounge. The Sea Fighter has had a lot or riders underway, and their briefings occur on the Mess Deck. Riders tend to use the crew's head, Mess Deck, and Crew's Lounge, thus depriving the crew of exclusive use. There are only three shelves to store food in dry stores. The refrigerator is also undersized. The Galley design is good, but it is too small.

Joint Navy/Coast Guard Crew

In previous Coast Guard duty stations, a BM1 was OOD underway and given lots of responsibility. In the Navy, E-7 and above are given responsibilities. E-6 and below do not receive the same respect as they do in the Coast Guard. This particular crew includes some E-7s who will roll up their sleeves and help; the Navy junior officers do not help.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Redesign stern ramp.
- Redesign X-Y crane.
- Design vessel with towing capability.
- Speed of the vessel is great!
- Maneuverability of Sea Fighter is good.
- Too many systems onboard are not interoperable.
- Anchoring arrangement is good – can anchor with two people, and raising the anchor is easy.
- Would prefer 4 additional crewmembers – would need at least 40 crewmembers to conduct sustained boarding operations.
- Give more thought about who builds the ship – this was Titan's first experience.
- Quote: "We have been forgotten by the Coast Guard and are being kicked by the Navy."

D.6.5 Interview of Enlisted, USCG

Background

Enlisted, USCG, is from Chesapeake, VA. Previous duty stations in the Coast Guard have included the CGC *Jarvis* (378' WHEC); Elizabeth City, NC; NESU Portsmouth; CGC *Farallon* (110' WPB) at the Coast Guard Yard (11 months); and a short tour at the Coast Guard Special Missions Training Center (SMTC) located at the Marine Corps Base Camp Lejeune, NC. He attended Old Dominion University (Engineering Technology), where he received his Associates Degree in Industrial Management and a Bachelors Degree. He is building a house in Cape Hatteras, NC.

He would like his next duty station to be MLCA, NESU Portsmouth, or the ELC in Baltimore, MD.

He was interested in the direct commission engineering program and was accepted to OCS but failed to pass his physical exam due to color blindness.

Duties

Primary duties include:

- MK1 in the engine room and auxiliary machinery spaces.
- EOW on the Bridge. Along with Chief Skinner, they were the first EOWs on Sea Fighter. The Sea Fighter should be operated like a 110' WPB where the EOW is permitted to leave the Bridge for up to 15 minutes (the EOW calls someone for help if the job takes longer than 15 minutes). This eliminates the need for the Rover watch, and the OOD could call the EOW if he needed him to return to the Bridge. The Rover watch does not make rounds in moderate weather. The EOW would rather stand his watch in the Engineering Operations Station (EOS), but he really needs to be on the Bridge. Currently standing 1-in-4 watch rotation, which could be sustained indefinitely.
- Boat engineer for launch and recovery (L&R) of the 11 meter RHIB. He was the first boat engineer on Sea Fighter. He was also a coxswain on the 378' WHEC and the 110' WPB. He practiced launch and recovery of a RHIB on an 87' CPB.
- Refueling the helicopter (if not on EOW watch) during flight operations.

Engineering Equipment and Systems

MTU diesel engines. These are the best engines and are highly dependable.

MCS-5. The control system for the machinery plant is great. This system, however, does not monitor the drain tanks, which must be pumped out by the Rover. The only way you can tell the drain tanks are dry is to feel the pump getting warm.

11m RHIB. Is too big; smaller would be better. It is easy to lose visual reference when approaching the Sea Fighter. It is like going into a tunnel; the 87' CPB does not have this problem. L&R of the 11m RHIB works now (since the Sea Fighter made some modifications to procedures). Now a person has to be in the bow of the boat during L&R. In less than one year,

the entire boat is totally covered with salt. When the mast has been dropped, you can't access parts of the boat for maintenance.

Sewage plant. The setup on Sea Fighter is preferred to the vacuum collection system.

Reverse osmosis water makers. Potable water can be produced at 100 gallons per hour, which is considered great.

Auxiliary machinery. Auxiliary equipment located in separate spaces is beneficial. There is a need for a sink in the sewage space to facilitate potable water tests. The chilled water plant is not well designed (designers overthought it).

X-Y crane is used to move cargo. The crane is very slow, and it can only be used in port.

The elevator works well. The elevator would have to be recessed 2 feet into the wet deck to make it flush with the Mission Bay deck. Doing this, however, would reduce the clearance in the wet deck above the water by 2 feet, thus increasing the likelihood and frequency of slams.

Flight Operations

The setup for refueling the helicopter is good, with the exception of the refueling pit hatch on the Flight Deck. This is a heavy hatch with a single dog and subject to pinching fingers. It was supposed to be a quick-acting watertight hatch.

Aviators would like to hangar the helo to protect it from weather and facilitate maintenance. How would you propose to accomplish this objective? Adding a hangar on the Flight Deck would achieve the goal with the sacrifice of one landing spot. This is a superior solution to the elevator solution, because the helo would have to stay on the elevator since there is not enough clearance between the stanchions in the Mission Bay.

Crew Size

Could sacrifice one engineer for one electrician.

If the Sea Fighter were to go out on Monday and come back in on Friday, preventive maintenance would not be accomplished. A solution would be to use a blue-gold team concept (or MAT team concept) where the 11m RHIB is dropped off for maintenance on the way back into port.

Engineering and Deck Dept. are fine, but the Sea Fighter needs dedicated shoreside maintenance.

Refueling Sea Fighter

The Sea Fighter refuels through the stern similar to a 110' WPB. Successful refueling depends on the skill of the OOD or whoever is controlling the throttles and steering on Sea Fighter. It is not possible to refuel Sea Fighter alongside (similar to unrep).

MSST Operations

The MSSTs would prefer to deploy with two HH-60s to facilitate delivery of a 16-person MSST onto a target of interest. The MSSTs would prefer to use their own 25' SAFE boats to the Sea Fighter's 11m RHIB. The existing 11m RHIB hangs off the end of the cradle. Overhanging the boat trailer or the stern ramp cradle would accommodate the 25' SAFE boat's outboard engines;

however, it is not feasible to bring the 25' SAFE boats onboard Sea Fighter due to headroom restrictions.

Habitability

Berthing areas. There are three man staterooms on Sea Fighter. Too much space on Sea Fighter has been devoted to Conex boxes on the Mission Bay, and too little room has been devoted to accommodation spaces.

The racks on a 378' WHEC and 270' WMEC are better than the bunks on the Sea Fighter. The Heads are OK; shipriders use the crew's heads, which denies the crew exclusive use. There are enough lounge spaces for the crew.

The EOS and the engineering Conex box are the only engineering work spaces; there is no Log Office. There is a lack of work spaces for the engineers. Enlisted, USCG, worked up a storage space design for all engineering spaces on Sea Fighter. In addition, a tool room is needed.

The Mess Deck does not have enough seats for every crewmember; however, the entire crew never eats at the same time anyway.

Ride Quality

Ride quality at 50 knots in 6-foot seas: bow on the ride is OK; following seas OK (because Sea Fighter is outrunning the waves); beam seas, the ride is bad. The ride quality of Sea Fighter at 50 knots is similar to a 110' WPB at 30 knots. At 10 knots in 6-foot seas, the ride quality depends on the sea direction. In general, the faster the Sea Fighter goes, the better the ride quality. It does not ride as goods as a 378' WHEC. In addition, the period of the waves is a big factor.

The Sea Fighter is bow-heavy, and the catamaran hull form accentuates the roll. There is a lot of vibration and noise during high-speed operations. The noise is acceptable to Enlisted, USCG, but unacceptable to the EM1.

When the Sea Fighter has a full load of fuel, it slams a lot even in 6-foot seas. Running at 24 knots, there are a lot of slams. In April 2006, the Sea Fighter sustained the biggest slam to date during rough-water trials.

Sea Fighter Principal Dimensions

Fifty (50) meters is the ideal length for the Sea Fighter (similar to a 170' WPC). Part of the savings in length could be gained by reducing the number of Conex boxes on the Mission Bay. The Sea Fighter has never had more than 8 Conex boxes onboard at one time, and the ship is designed for 12. A smaller Sea Fighter could be operated by with two diesels (and no gas turbines) at 45 knots. A multi-hull Sea Fighter would be a good replacement for the 110' WPB, where auxiliary spaces are forward and the fuel tanks aft. The Sea Fighter was originally 55 meters, but the Navy pushed it to 73 meters.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Avoid Navy crew.
- Avoid single dog doors and hatches. Single-acting watertight doors should be used everywhere.

- Current composition of crew is incorrect. Could operate the ship with even less than 26 crew, but you need a second cook. The number of crewmembers is fine, but we have never manned CIC.
- Speed of Sea Fighter is very beneficial compared to a 210' or 270' WMEC. However, you still need to helos to catch go-fasts, which are doing 60 knots. Sea Fighter is inadequate to catch these go-fasts.
- The CMT mission requires a MSST to board a merchant ship 1,000 miles or better outside the U.S. Of the three (378', 270', or Sea Fighter), Sea Fighter is better by far for the CMT mission due to her speed.
- Gunners were easily able to train Sea Fighter’s weapons on small boat targets even at 49 knots.

D.6.6 Interview of Enlisted, USCG

Background

Enlisted, USCG, is from Buffalo, NY. His next duty station will be a 110' WPB in St. Petersburg, FL (CGC *Pea Island*). Previous duty stations in the Coast Guard have included the Aids to Navigation Team (ANT) in South Portland, ME. He really enjoyed that assignment, which included maintaining 23 lighthouses and three ranges between Rockland, ME, and Portsmouth, NH. In another previous assignment he was responsible for Great Lakes lighthouses. In addition, he was stationed on CGC Bramble (a 180' WLB).

Duties

Primary duties include:

- EOW watch underway on the Bridge. The EOW stands his watch behind the OOD, talking to his back may be a distraction to the OOD. The EOW also has a monitor that rotates among the engineering spaces providing a view of the space in real time. Standing this watch on the Bridge is helpful to the OOD, but ideally standing the watch in the Engineering Operations Station (EOS) would be better and allow the EOW to control a casualty on scene. The ship's machinery is split between the two hulls, but there is only one EOS in the starboard hull. One EOW standing watch in the EOS would be adequate, because a small crew is responsive when help is needed or an emergency/casualty occurs. The switchboard can be operated from the EOS. Do you need an EOW and a Rover on watch at all times? Answer: On a military ship, yes; on a civilian ship, the EOW could handle it alone.
- Hot suit man for flight operations.
- EM1. One electrician on this size ship is tough. The Siemen's switchboard is great; we rarely split the bus. Generators work well. There are four ship service generator sets; due to Navy requirements, we always run two and they are always underloaded. The Navy did not know what equipment and systems we have and tried to implement their preventive maintenance system; this was a crazy idea.
- The Engineering Department consists of two people assigned to auxiliary, two people to main propulsion, two electricians, one main propulsion Chief, one Auxiliary Chief, and one Chief Engineer, for a total of nine people.

Engineering Plant

- The MTU RCS-5 system is great.
- The ride control system is very good.

Boat Operations

Not involved in boat ops, but the stern ramp design is awful. The angle of the ramp is bad. The BM1 modified the ramp to make it better.

Flight Operations

The 6-person Flight Deck crew is all that is needed, considering the rest of the crew is available to back up the Flight Deck crew when needed. In training, this crew actually put out a Flight Deck fire. Technique is important in extinguishing the fire. What is the fire rating of the Flight Deck (length of time it will withstand fire before failing)? Answer: Don't know.

Mission Bay

Have you ever needed the services available to the modules in the Mission Bay? The modules come with their own air conditioning.

Habitability

Enlisted, USCG, shares a room with one other first-class petty officer. The rooms are way too small; only one person at a time can access their locker. The rooms are noisy underway. The rooms were designed by a Captain submariner. He would prefer a 40-person berthing area with more room. Heads are adequate. Mess deck is OK. The lounge works well. The Galley is sized correctly for a crew of 26. The Galley and Mess Deck are not sized to handle the many riders we usually have on board. The crew has nowhere to go when off-watch; there is no log office or engineering work space.

Ride Quality

The noise at 50 knots in 4- to 6-foot seas makes him sick. He attributes the noise to "the aluminum hulls, which act like a tuning fork." The ride quality at 20 knots is great; the noise starts to become an issue at 30 to 40 knots. From 10 to 20 knots in 4- to 6-foot seas, the ride is fine. Drifting up to 5 knots, the ship moves a lot, making it difficult to work.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- In general, Enlisted, USCG, likes the ship a lot, but Titan/Nichols ran out of time and money and had to deliver the ship so testing could begin.
- Redesign the stern ramp.
- Improved access to Flight Deck. The elevator is in a bad location and does not work well.
- Improved access to ship. There should be a side door in the starboard side in addition to the existing door on the port side of the Mission Bay.
- Improved SOLAS boat. Location and the way to launch and recover it should be improved.
- Redesign rolling Mission Bay doors. Good idea but bad design. These doors are needed to separate the Mission Bay into sections to contain migrants, reduce noise, permit heating and cooling of specific sections, and prevent sucking fumes from gas turbine exhaust into ship's ventilation system.
- Intake for engine room aft allows salt air infiltration into engineering and auxiliary spaces, resulting in coating everything in salt. Some vent fans have had to be rebuilt due to salt corrosion.
- Ship's computers and Local Area Network (LAN) are installed on the mezzanine deck. This

permits exposure of the electronics whenever the elevator is lowered to the Mission Bay

- Which is better, a hangar or an elevator large enough to lower a helo into the Mission Bay? Answer: An elevator located on the stern.

D.6.7 Interview of Enlisted, USCG

Background

Previous duty stations included a Coast Guard Small Boat Station and operations involving a 47' boat. His next duty station is the tactical LEDET in San Diego, CA. This was his first choice for assignment, and the detailer has promised that he will receive these orders.

Duties

Primary duties include:

- Navigator of the Watch (NOW). He was originally assigned Rover for about a year. Then, at his request he was switched to NOW watch. The layout of equipment on the Bridge to support the NOW watch is good. He has heard that ECDIS on Sea Fighter requires a lot of keystrokes. However, this is the only system he has ever seen, so he cannot comment. Bridge visibility is pretty good except at night; never asked for NVGs (can add 3× magnifier), only used radar. Rarely used IR camera; range of this camera is unknown.
- Chock-and-chain gang for flight quarters. The tie-down system on the Flight Deck is OK.
- Special Sea and Anchor Detail: Forward mooring station with BMC, ITC, and himself (GM2).
- Small Boat Operations: Qualified to run all 11m RHIB launching machinery, including the ramp and the winch.

Mooring

HM1 and others who are not proficient are assigned to working lines. Mooring is an ordeal; putting lines over is unique to this vessel. The lines are made of Kevlar, so they are light enough to handle with two men. The ship normally ties up port side to the pier. Line handling reels in the fo'c'sle and Mission Bay keep the mooring lines dry.

The 50 caliber machine guns are manned for Special Sea and Anchor Detail, but the Coast Guard does not do this. He thinks manning the guns is only for looks and useless because you would not open fire in San Diego Harbor. The Sea Fighter could not defend itself as well as a small boat, because self-defense was not a design concern. The 50 caliber machine guns are stowed in the Mission Bay. It is a pain obtaining permission to use the elevator to transport the guns to the Flight Deck, so they are carried up by hand.

Crew Size

The Sea Fighter typically sails with some crewmembers missing. For example, last trip we were missing the ET1 (hernia), Ops Officer (hernia), ETC Wheaton (bad back). In addition, we are missing our BM2. The first BM2 was injured in a motorcycle accident; the second BM2's fiancée suddenly died, so we are currently short one BM2.

Small Boat Operations

The 11m RHIB is constantly broke, and the 17-degree down angle for the ramp causes most of the problems. As part of the boat crew, he has to lasso the bitt when the boat is coming up the

ramp during recovery operations. On an 87' CPB, the ship tosses a line to the boat when it is coming up the ramp (it's just the opposite on Sea Fighter).

Flight Operations

Originally there were two Flight Deck teams, but this idea was scrapped. Eighty knots of wind across the deck is not a problem. We landed a helo once in 50 knots of wind; the LSE had to go inside, and the helo landed on its own.

Habitability

The Mess Deck is adequate for 26 persons; however, if the crew gets bigger, the Mess Deck needs to be bigger. We have always had riders, which have pushed the capabilities of the Mess Deck. Converting the wardroom to the Crew's Lounge was a good move. There are no places to go when off-watch underway, but since this ship has been underway so little, it has not been a problem. Crew cannot use the workout equipment on the Mission Bay when the ship is underway. He is happy with the berthing; he has never been on another ship, but having seen other ships' berthing areas, he loves his three-man room. He gets dressed by flashlight. The heads are adequate.

Mission Bay Equipment

The X-Y crane is frequently broken; part of it fell during a repair once, so all crewmembers avoid walking under it.

The elevator is made for small cargo and Conex boxes. It is 1.5 feet off the deck when lowered into the Mission Bay, which makes moving items on or off the elevator a real pain.

Ride Quality

The ride quality is great at 40 to 50 knots in 4-foot seas. Ride quality is better at faster speeds and worse at slow speeds.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Operate the Sea Fighter at high speeds to maximize ride quality.
- The Flight Deck is good; the addition of a hangar would make it even better.
- The right size crew for this vessel is probably 35, but it depends on the length of time you are underway.
- Some billets need to be restructured. For example, a CWO, ETCS, IT2, and an OS2 in the Comms Department is bad.
- Mission Bay. For Coast Guard purposes, you don't need a Mission Bay that can carry mission modules.
- Ability to launch multiple boats would be good for the Coast Guard.
- Redesign the X-Y crane.
- Would like to see a 25 mm gyro stabilized gun.

- Would like to see an armory to store 1,200 rounds for the 50 caliber machine guns, which is adequate for the four weapons.
- Use the Sea Fighter for staging an MSST? Could easily be done. The berthing module could be used for the team, and the stern ramp could be configured to handle their boats.

D.6.8 Interview of Enlisted, USCG

Background

Reported onboard Sea Fighter in October 2005, replacing the first MK2 who broke his knee going through a hatch during a main space fire drill. Previous duty stations included a 378' WHEC (CGC *Mellon*) and Sacramento Air Station, where he ran the GSE shop (HVAC and yellow gear). Enlisted, USCG, left the Coast Guard and worked in the HVAC field for 7 months. He had one year to change his mind if the rating was still open, so he reentered the Coast Guard. While on the *Mellon,* he did a SOUTHPAC Drug mission and a patrol in Alaska.

Duties

Primary duties include:

- The MK2 and EN1 are the two engineers in the Engineering Department assigned to the engine rooms. The MK2 is responsible for the port engine room, and the EN1 is responsible for the starboard engine room.
- EOW watch. He is qualified as EOW, which is a big thing in the Navy but not in the Coast Guard. He thinks the EOW should stand his watch on the Bridge but be permitted to leave the Bridge for short periods as needed, and eliminate the Rover watch. The OOD who has an identical console to the EOW can cover for the EOW during short absences.
- Rover watch. He is qualified as Rover. The Rover watch makes rounds and takes readings, but this is not necessary since the computer records hourly readings.
- Man 50 caliber machine guns during Special Sea and Anchor Detail.
- Linehandler, aft mooring station.
- Damage Control Assistant. On this ship the philosophy is if you can't quickly extinguish the fire, you abandon ship. The location of DC lockers is OK.
- Boat Engineer or Rover during flight operations. Alternates with the EN1.
- Backup elevator operator.

Crew Size

Due to the small crew size, an E-5 on Sea Fighter is equivalent to a FN (E-3) on other Coast Guard ships and is responsible for cleaning. There are numerous E-6s assigned to Sea Fighter, and E-6 and E-7 do not just supervise, they roll up their sleeves and do actual work. There is a GSM3 in the Engineering Department who is junior to Enlisted, USCG; however, the GSM3 is solely responsible for the gas turbines and oil king duties.

Engineering Plant

Waterjets leak into the bilges, but due to poor design, a crewman must go into the bilge and use a paper cup and bucket to remove water that leaks from the waterjets. Due to the fact that duplex strainers are not installed and the installation of the simplex strainers in close proximity to the shafts, it is necessary to shut down an entire shaft to clean the simplex strainers, which clog with

kelp and seaweed. The reverse osmosis water makers are easily able to keep up with demand, and there is no restriction on the use of fresh water. There is a need for additional capacity for washing down a helicopter on deck.

The MTU main diesel engines are awesome. They are easy to work on and easy to maintain. A special tool had to be purchased to maintain the main diesel engines that cost $16,000. Leaks below the deck plates are very difficult to access and repair. ICAST is very poor and causes the majority of the leaks; the computer side, however, is awesome.

Due to a casualty of the auxiliary saltwater pump (30 psi), we did an emergency cross-connect to a saltwater pump (50 psi) in a different saltwater cooling system. Because of the greater pressure, we blew hoses and seals. This problem would not have been an issue if there had been a redundant pump in the first place.

Habitability

The three-people berthing area is too small. There should be more vertical separation between the bunks. The heads are fine. The Mess Deck is adequate for a crew size of 26. The Crew's Lounge is frequently taken over by shipriders for briefings and meetings.

Ride Quality

The ride in general at slow speeds is poor. At higher speeds, such 40 to 50 knots in 4-foot seas, the ride is not bad. When drifting, the ride is very bouncy and you get tossed about. When the ride is bad, sometimes a second person who acts as a safety observer must accompany a crewman who needs to access the engine room. There are some whistles due to unbalances in the ventilation system. The T-foils make noise.

Small Boat Operations

Launch and recovery operations are difficult. Need full throttle to come up the 17-degree stern ramp angle and hold it until the crewman in the boat lassoes the bitt. This procedure is killing the boat's engine. The Cummins engines in the 11m RHIB are OK, as are the waterjets and trim tabs. The hoses, however, chafe on the shaft and eventually start to leak.

The SOLAS boat "scared the crap out of me." Hanging from the single point davit gives one a sense of helplessness. If it was a single point davit such as on the 378' WHEC it would be OK, but this one swings 270 degrees, which is a real problem.

Sea Fighter on a Typical 378 Law Enforcement Patrol

The Sea Fighter would be awesome in Alaska. Weather would be a problem in the Bering Sea, and towing would be a problem because Sea Fighter cannot tow fishing vessels like the 378s can. The berthing areas are sized better on a 378, and they have dedicated Crew's Lounges and other spaces where the crew could go off-watch.

The Sea Fighter would be better with an all-Coast Guard crew. There's a bigger gap between enlisted and officers in the Navy. In the Coast Guard, enlisted can talk to officers – not so in the Navy.

Two weeks underway on Sea Fighter is equivalent to two months underway on a 378.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Crew size would be larger if this were a multi-mission Coast Guard vessel. The correct number of crew should be 35; depends on ratings assigned. The CS1 needs help. Need some non-rates and balance among the ratings with more 2 E-6 and 4 E-4 for every E-7 for example.
- Bigger staterooms are desirable. E-7 and above should be two-man rooms, and E-5 to E-7 should be three-man rooms.
- The MTUs and CODOG feature of the engineering plant should be retained.
- The EOW watch should be retained.
- The stern ramp should be redesigned.
- Hard piping for the waterjets would reduce leaks.

D.6.9 Interview of Enlisted, USCG

Background

Has two years in the Coast Guard. Home is Mississippi. Sea Fighter was his first duty station following "A" school. He is the youngest crewmember and is unable to accompany shipmates into a bar while on liberty. He was the only non-rate when reporting aboard. Next month he will be promoted to 2/c. He is the only OS onboard. He started out as an engineering rover under instruction. This was soon changed to a Bridge watchstander.

Duties

- Stands watch as Navigator of the Watch (NOW).
- Linehandler during Special Sea Detail.

Bridge Arrangement

The efficiency of the Bridge layout is rated 4 out of 5. Pros and cons: Chair breaks all the time, but layout permits access to everything. Visibility is great. CIC is not functional. VHF is on the Bridge, but Comms must be installed in a functioning CIC before RIMPAC.

Linehandling

Because the ship is so maneuverable, lines can be handed to the linehandlers on the pier. However, because of the way the fo'c'sle is enclosed, someone has to go outside the ship on the bow catwalk and throw a heaving line back to someone else in the fo'c'sle in order to put over the #1 line. Comms from the Bridge to linehandlers is via handheld radios, and there are some dead spots in the vessel where this means of communication is not possible.

Small Boat Operations

The following are needed/used to launch and recover the 11m RHIB via the stern ramp:

- 1 person to operate the ramp
- 1 person to operate the winch
- 1 safety observer
- 1 coxswain in the boat

The end of the stern ramp comes out of the water as the ship pitches in response to the seas.

Habitability

One cook is insufficient. One person from each department would rotate through mess cook daily; this was changed to weekly. On most recent trip to Canada, a cook had to be assigned TAD. Entire crew cannot eat simultaneously (16 chairs in the Mess Deck), but there is no need for the entire crew to eat simultaneously, so this is a non-problem. When off-watch, there is little for the crew to do and limited spaces where they can relax off-watch. Berthing areas typically contain three racks (one stack) and three lockers (stacked). It is tough to get into the top rack. If

three people are all in the berthing area, one has to step into the head in order to permit room for the other two to dress. Heads are not as cramped.

Ride Quality

The faster the Sea Fighter goes, the better the ride quality. In flat calm the ship rides well. Loitering in higher sea states results in the crew being thrown around due to unpredictable ship motions.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Change X-Y crane to one designed for a ship.
- Redesign stern ramp to be less hazardous.
- Due to his age (youngest crewmember) he cannot go on liberty with rest of the crew, resulting in a case of boredom.
- Tired of seeing same 26 people all the time.
- Doesn’t notice speed of the vessel.
- Would not recommend the Coast Guard obtain a Sea Fighter without significant redesign and improvements.

D.6.10 Interview of Officer, USN

Bridge Operations

The OOD on the Sea Fighter controls the helm. Coast Guard cutters do not operate this way. He can see that the system on the Bridge of Sea Fighter could break down in a flight operations environment. The solution would be to transfer maneuvering control to the NOW and make the OOD the conning officer and add another body to direct the helm. The downside of this solution is the fact that the radars are linked to the NOW and OOD's watchstanding position, so the OOD would lose access to the radar monitor.

The Bridge is set up with chairs for the OOD, CO, NOW, EOW, and TAO. This provides good situational awareness between deck (Bridge) and engineering (EOW), which had always been a struggle previously. It's hard for the EOW in the engine room to get a sense of the urgency of the situation on the Bridge. The EOW on Sea Fighter is involved in discussions and planning, and the CO gets immediate feedback from the Bridge Management Team. The bad things about the Bridge layout are increased noise and light (at night), which are distractions. To reduce the noise level, you need to reduce the number of people on the Bridge to a minimum. However, training break-in watchstanders directly contributes to increased noise from the verbal instructions the break-in watchstander is receiving. In addition, the engineers are not used to being quiet while on watch; this is a new environment for them. The focus on the Bridge must be on navigation and operation of the ship. Perhaps the EOW should have a black curtain or some sort of separation placed around the EOW watch station.

The Sea Fighter has not operated with a CIC/TAO watch. He expects to find dissatisfaction. The TAO/CIC watch officer's job is to gather and disseminate information. CIC is inherently noisy due to the deconfliction and collaborative effort required. It's going to be hard to make this work. CIC is also limited in its ability to display radar information. As CIC's role grows, it will be necessary to determine the best location for the TAO to direct combat operations. If the TAO is on the Bridge, it will undoubtedly increase noise levels.

Titan showed the CO the 50m version of Sea Fighter. The Bridge layout seems to make sense, it is easy to deconflict emerging issues quickly but still maintain segregation of functions.

The CO's chair is in the middle of the Bridge. This permits the CO to view the radar monitors at the NOW and OOD's watch station, which provides good situational awareness. But if the NOW or OOD has their chair in the forward position, the CO's view 45 degrees off the bow is blocked – and that's where the problems come from. In addition to lacking clear lines of sight, the CO's position does not have direct access to Bridge-to-Bridge communications, which he needs.

The visibility from the Bridge is good, not great. The CO is used to standing watches on the Bridge standing up at the windows. He is not used to sitting in a chair on the Bridge. He thinks they need wider consoles and an elevated CO's chair located slightly farther aft. The Bridge is offset to port to allow a runway for the UAV, but it never happened. He prefers a beam-wide Bridge with Bridge wings. The LCS-1 was redesigned to include Bridge wings. If the Bridge must be offset, it should be offset to starboard like an aircraft carrier, with its island on the starboard side so that the OOD is on the green side of the channel.

In general, the controls are satisfactory. Bridge controls include the autopilot. Speed tables are needed because the throttles are not linear, especially on gas turbines. The OOD takes the joystick during docking. The ship is so maneuverable, it is possible to dock the ship even under bad environmental conditions without damaging the ship. The autopilot is used even in the channel, where the OOD is acting as the Conning Officer. The autopilot can control the ship within 0.5 degree in the channel and within 1 degree when wind and current are adverse. The OOD can control the maximum angle of the waterjet (0 to 30 degrees) and the maximum rate of turn or maximum radius of turn. The rudder coefficient is set at 2 degrees of waterjet for every degree of course change, with a 1.5-degree dead zone either side of midships. Autopilot controls got messed up on the trip down from Canada, and the OOD had to steer manually. The problem has since been fixed.

The ship is very maneuverable because the beam-to-length ratio is small. But due to this ratio, the ship does not do well in following seas. Doing an unrep in following seas would be a problem.

Engineering Plant

There are no complaints with the engineering plant; it is well designed. Getting oil out of the bilges is a problem, as is everything else below the deck plates because of the long and narrow hull forms.

Ride Quality

Fifty knots in 6-foot seas is not an issue; 45 + knots in 8.5-foot seas is a good ride. There are no excessive accelerations. This ship exhibits a reverse bell curve for speed/seas/wave period. In short period waves (6.5 seconds), the ship rides on the wave crests. Long period waves (8 seconds), and the ride is bad; 13- to 14-second periods are equivalent to significant swells. At 10 knots in 6-foot seas, the ride control system is not effective and beam seas are uncomfortable. Faster is better (depending on wave period). At 30 knots, compared to a DDG, the ride is better on the bigger DDG; a longer ship spans the waves eliminating slams. Smaller ships notice movement more. The ride on Sea Fighter is a different type of motion; it is a herky-jerky, short duration type of movement.

Crew Accommodations

The crew's quarters are pretty adequate. Enlisted guys on gray hulls are in 30-, 40-, even 80-man berthing areas; this is a step up. Vertical clearance between the bunks is an issue. The crew likes their privacy, but some prefer the greater space available in the 40-man berthing area. More document stowage space is needed. The Mess Deck is OK; nobody has to wait due to lack of available seating. The lounge is also available as an overflow Mess Deck. There are limited places for an off-watch crewmember to go to relax. With two LTjg's, there is a reasonable number of chiefs and officers. The Sea Fighter has a lack of admin spaces; we need more office space. The first CO converted the wardroom to a Crew's Lounge; this CO would have had a tough time making the same decision. When you have 5 to 6 officers, they need a space separate from the crew.

Crew Composition

Duncan Hunter is forcing millions of dollars on the Navy to operate this ship. The Navy did not want it to begin with, and nobody in the White House is coming to the rescue. The crew composition is dependent on mission. The GM on Sea Fighter gets minimal employment. He assists the deck department, which is better than the deck department maintaining the weapons. The OS3 is not really used as an OS3; he is underutilized. As CIC watches are stood up, this may change. A Navy OSC will replace CWO Leary as Comms Officer. The IT2 is utilized differently in the Navy compared to the Coast Guard. The Navy uses them to maintain their Local Area Network (LAN). Is 26 the right number for crew size? Yes. He would swap the GM2 for an FC2 to operate the close-in weapons system.

Boat Operations

The stern ramp on Sea Fighter is not the final answer. It was designed to roll-on/roll-off a HUMVEE. However, the elevator is a better way to get the HUMVEE onboard than using the X-Y crane. The best way to put the boat in the water is to have an elevator that goes up and down with the boat cradle horizontal. This would also enable transporting things from the water to the Flight Deck. Seventeen degrees is the current down angle of the stern ramp. The new Titan design is 12 degrees. The Coast Guard has standards for launch and recovery (L&R) of small boats. The Navy prescribes L&R of small boats at 5 knots up to sea state 4. The Sea Fighter achieved this standard. It was scary and we would prefer not to do it, however. The coxswain prefers beam seas so that the stern ramp does not pitch out of the water.

Flight Operations

Flight operations on Sea Fighter is easy. The proof of the pudding will be an aircraft crash. Flight operations are normally manpower intensive, but we could not afford that many people. The aviators want a hangar for their helo. There appears to be two options: Install a hangar on the Flight Deck and sacrifice one landing spot, or install an elevator large enough to hold an HH-60 or HH-65. If the Mission Bay were converted to a hangar, it would consume a lot of the space currently in the Mission Bay; this has implications on cost. A retractable hangar on the Flight Deck would result in a loss of visibility.

Payload Flexibility

The Mission Bay has great flexibility. Most Coast Guard cutters do not have the mission payload capability. If the ship were to be built with missions in mind, it would make sense to build it out – a migrant holding tank for example. A reconfigurable Mission Bay hides costs for the Navy. The true cost for the LCS is X (the GAO will figure out what X is). Admiral Cohen liked the Mission Bay concept. The Mission Bay on the LCS is believed to be smaller and more constrained than Sea Fighter's. From the CO's perspective, the Mission Bay can be used for a wide variety of gear, and reconfigurability means flexibility, which is good.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- CIC (woefully lacking on Sea Fighter).
- Mast-mounted phased array radar.

- Air search radar and surface search radar, with a navigation radar as backup for the surface search radar.
- LINK capability and full-featured IFF.
- Self-defense against missiles (either CIWS or RAM).
- Kevlar armor protecting vital spaces.
- Ability to use bleed air from one gas turbine to start the other (currently have to wait for air pressure to build up before starting second turbine).
- More berthing (for detachments).
- More permanent berthing, including a couple 6-man spaces for junior enlisted/transient personnel.
- Enhanced berthing module (include better ventilation and fewer bunks).
- A functional CIC with ability to display the surface picture and control weapons.
- Retain the engineering plant (except for some minor fine tuning), especially the MCS-5 control system.
- Ability to clutch out waterjets individually (currently, lose one and you lose the entire shaft).
- Retain the navigation system. Like the concept, operation, and software. Navy likes the Sperry system; the Coast Guard likes the offshore system.
- Retain the autopilot.
- Retain the Flight Deck lighting system – it is great.

Officer Billets on Sea Fighter

The CO billet on Sea Fighter is O-3, currently filled with an O-4. Since the Sea Fighter is not asked to do anything, it is difficult for the CO to exceed his authority. The PC-170s are currently operating, pursuing the counterterrorism mission. The CO on a PC-170 is a second-tour department head job – similar to this CO.

A Coast Guard officer is XO on Sea Fighter. Normally the Navy would probably follow their policy for staffing a minesweeper (O-4 for CO and XO is a second-tour dept head who would fleet up to CO after 18 months onboard). The new Navy policy of fleeting up the XO to be CO after 18 months applies to all Navy ships except nuclear aircraft carriers and PC-170s. The PC-170s do not have an XO. The Sea Fighter needs an XO; he should be a third-tour division officer (very experienced). Department head billets (XO, Ops, 1st LT, Eng, Electronics, and Nav) should be 24 months.

The XO has orders to PCO/PXO school and will not make the transit to Hawaii for RIMPAC. He will be replaced early (and before the transit) by the Navy LT currently in charge of the Maintenance Support Team in San Diego that has been supporting the Sea Fighter.

How Should the Navy Use Sea Fighter?

If the decision is to deploy it, missions could include light intratheater or special warfare lift. It could be a boarding platform, since it is fast and can catch people. In support of coalition forces, it could be used as a lily pad, since it is fast response and capable of shallow draft operations. The Sea Fighter is not good as a PC. It is a good platform as is for the counternarcotics mission. A Flight Deck shelter is needed to support longer reach/AUF. It is a good show-the-flag platform. It is economical on diesels, has a small crew, and can access ports due to its shallow draft. It has a small impact in a port.

An integrated Coast Guard/Navy crew is not likely to happen again. Coast Guard LEDETS on Navy ships and the Navy Officer Exchange Program are other examples of successful Navy/Coast Guard integration. The Coast Guard and Navy have shared traditions and speak the same language. The attitude about “doing things the Navy way” versus “doing things the Coast Guard way” has to be overcome. Training track schools are taken out of hide in the Coast Guard; the Navy does not do this.

D.6.11 Interview of Officer, USN

Background

Reported onboard Sea Fighter in February 2006. Came from an FFG, which was his first ship. The Navy sent him to Auburn University (his fifth choice), where he studied electronic warfare.

Duties

Primary duties include:

- OOD watchstander
- Navigator
- TAO (when CIC is functioning and not OOD)

Bridge Layout

On Coast Guard ships, the helmsman and not the OOD steers the ship. As OOD on Sea Fighter, he is both OOD and helm. He is used to verbalizing everything. On Sea Fighter he has all the tools at his fingertips, but it's still important to communicate what he is doing. The layout of the Bridge includes the NOW to the left of the OOD, which is good. The close proximity on the Bridge of the NOW and CO is good. There is no head available to the Bridge watchstanders (must call for relief to use the head).

While operating at 50 knots, it is easy to lose situational awareness. The navigation software requires many keystrokes, and if you mess up you have to start all over.

The procedures for man overboard include slewing the ship around, which risks shutting down the gas turbines due to air cavitation. Then you put the boat in the water.

The visibility on the Bridge is 360 degrees except for the starboard side, but you cannot look up because there are no open Bridge wings.

As OOD, he tries to drive the ship manually (opposed to using the autopilot) as much as possible. The first CO encouraged him to drive manually. The ship leans outboard in a turn, but not excessively. Hard turns slow you down more than it leans outboard. The autopilot is nice, but sometimes it keeps turning (maybe as much as 30 degrees too far before it compensates). A nice feature of the autopilot is auto track correction. Quartering seas are the worse for the autopilot. Wind is no problem.

He has docked the ship many times. It is possible to walk the ship sideways into the pier using the joystick. If he is not the OOD, his special sea and anchor detail assignment is at the navigation table as an extra pair of eyes. If the OOD is operating the joystick and maneuvering the ship into the pier, he cannot communicate with linehandlers and the XO takes control of the linehandlers (but the OOD remains in charge). The capstans are terrible; the Kevlar mooring lines slip on the capstans, rendering them useless.

Habitability

Staterooms need a TV drop. He does not live onboard, but there is no place to go when not on watch to get away from the crew. There were many places to go on the FFG. The staterooms

have no power outlets or place to put anything. The Galley setup is good except for the stove. There is no APC fire extinguishing system installed to fight a grease fire. The Galley deck is slippery when wet. Officers typically stay out of the Crew's Lounge. He likes the fact that on Sea Fighter officers and crew work closely together, but they need to get away from each other occasionally.

Ride Quality

Ship motions are unpredictable and exhibit a side-to-side, jerky type of movement, which tends to make you seasick. The ship rides terribly at 50 knots. Pitching is not bad, but there is side-to-side shimmy, which "gets to you." At 20 knots in 8- to 10-foot seas, the ship is subject to slamming, depending on wave period. The envelope of operation as published by ABS is not accurate, because faster is better in terms of ride quality. At 25 to 30 knots in moderate seas, the ride is great. While loitering, the ride is terrible.

TAO Watch

It is not clear how the TAO watch will work. Expect a lot of traffic in RIMPAC. Not sure how deconfliction will occur between the OOD and the TAO. International comms will be over Centrix and NIPRNET. Concerned about confusion on the Bridge. Other Navy ships have a functioning CIC and TAO with separate responsibilities. On Sea Fighter, due to minimal manning, there may be a problem.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- No aluminum ship should go into a naval battle.
- One of the two life raft stations on Sea Fighter may not be usable due to list.
- Auto logging and paperless navigation are great.
- Crew comfort stuff should be retained.
- Office of Naval Intelligence should not stop and continue with advances in navigation systems, but they need to be flawless.
- Waterjets are good and should be retained.
- Khaki mess or khaki lounge? It is OK for the officers and crew to eat together.
- There needs to be a compartment with a refrigerator, TV, desk, and computer for the officers and chiefs to go and relax.
- Crew size? There are too many senior enlisted on Sea Fighter. More junior guys adapt more easily to electronics. Manning levels need to be looked at closely.
- Stern L&R of the 11m RHIB. Great, but should get rid of the warning light and bell.
- The X-Y crane needs to pivot
- It takes too long to accelerate from 0 to 50 knots. It takes 5 minutes for the turbines to cool down after running for one hour.

D.6.12 Interview of Officer, USN

Background

Previous duty station included a shipboard tour on a DDG.

Duties

- OOD watchstander and OOD for flight operations and man overboard
- 1st LT/weapons officer

Bridge Layout

The OOD acting as helmsman is a great thing. On his first OOD watch on a DDG, he was transiting out of San Diego at 27 knots; due to a whale sighting close aboard, the OOD directed the helm to be put over hard but forgot to shift the rudder, resulting in killing the whale with the propeller. The process was further slowed by a break-in helmsman receiving instruction from a qualified helmsman. If the OOD directly controlled the ships movement, any possibility of this problem recurring is eliminated.

During high-speed operations, you do not concentrate on the centerline pelorus. Instruments are used a lot. The first CO used Night Vision Goggles, and there was a body assigned to continuously look at the monitor for it. It is considered a last-ditch safety device. The OOD should be on the centerline.

Controlling the ship in stern quartering seas is difficult because the ship wallows. The throttle is imprecise. A thumbwheel is needed to effect small rpm changes. It is difficult to inch forward the T-handle. It is difficult to find the center of the joystick; it stays where you put it and does not spring-load back to center. Normal operations underway use the T-handle and joystick when docking. Waterjets are sluggish and need to respond more quickly; there is a delay before they respond.

The docking display is great. Communications are fine, and docking the ship is easy with the help of the cameras.

OODs like having the EOW on the Bridge, which enables the EOW to remind the OOD of casualties.

There is a better navigation software package available [than the Sperry system on Sea Fighter]. It allows scrolling ranges without reloading DNCs.

The placement of speakers associated with the comms gear on the Bridge is OK, but the placement of microphones needs to be changed to permit easy access by the OOD.

Flight Operations

Flight ops on Sea Fighter are easy. The HCO runs the show from the tower. The OOD just drives.

Mission Bay Equipment

The stern ramp works well. The X-Y crane is terrible. It broke loose once and had to be corralled. The X-Y crane is a great idea, but you need the ability to pivot. The Mission Bay results in a lot of wasted space that could have been used to give the crew more room in their accommodation spaces. The isolation doors on the Mission Deck do not work.

Placement of loads is an issue. To compensate for the placement of loads on the Mission Deck fuel is moved around. This means Sea Fighter never tops off on fuel. If 100 percent fuel is taken aboard, the ship is down by the bow and the ship is sluggish.

Habitability

The Mess Deck is OK for the crew, but he would prefer a wardroom. If the staterooms were bigger and had a TV drop, they would be fine. The problem with the staterooms is they were designed by a submariner. Another cook is needed. An officer’s lounge (shared with the chiefs) would be great.

Ride Quality

At 50 knots in 4 to 6-foot seas, the ride quality is dependent on wave period. At 10 knots in 4- to 6-foot seas, the ride is not so good.

Boat Operations

Launch and recovery of the 11m RHIB is fine in low sea states. In high sea states, the ramp emerges periodically from the water. Can that feature be redesigned? There must be a way to do it. The 11m RHIB is fast. Recovery of the RHIB in minimal sea states is OK.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Fifteen more bodies across the board.
- Fix berthing (too small). Staterooms should be two-man rooms with more space than current rooms. DDGs had two man staterooms, and Sea Fighter represents a downgrade.
- Need more accommodation space and places to go while off-watch. On Sea Fighter a person does not get enough exercise and tends to eat too much. The ship movement prevents using the exercise equipment underway.
- Retain the OOD and NOW watch positions on the Bridge.
- Retain the propulsion system; however, the ventilation system [to the engineering spaces] needs to be improved. The “spoilers” that were added to the hull forward of the gas turbine exhaust should be eliminated.
- Speed of the Sea Fighter is beneficial and should be retained. The Sea Fighter can easily keep up with the 25' SAFE boats used by the MSSTs.
- A hangar on the Flight Deck is a better solution than a larger elevator to lower the helo into the Mission Bay. If the helo were to be “hangared” in the Mission Bay, there would be insufficient room for the aviation detachment.

- The Sea Fighter is not ready to deploy with the fleet or make the 10-day transit to Pearl Harbor.
- The Sea Fighter is set up to take on fuel via unrep; however, it was never accomplished. Unrep was not done because the Sea Fighter could not control their speed and heading well enough. Therefore, refueling by streaming the refueling hose aft from the ship that was towing the Sea Fighter was accomplished. However, the riser was nearly torn off in the process. The Sea Fighter is not planning to take on fuel during the transit to Pearl Harbor.
- Parts support is often delayed, since parts frequently have to come from Europe. For example, the door that separates the heads on the chem-bio path comes from Poland.

D.6.13 Interview of Officer, USN

Duties

Officer, USN's primary duties include:

- Chief Engineer. The only other CHENG billet for a CWO in the Navy is the PC-170. In the Navy, Warrants and LDOs are interchangeable. He has always been a main space engineer. The quality of life on Sea Fighter is good – no one bothers the CHENG.
- EOW watchstander underway. Stand watch on Bridge opposed to Engineers Operating Station (EOS). The EOW is the only one who can see through the blind spot on the Bridge. The EOS does not have emergency stops installed. The EOW needs to be on the Bridge to be available to take immediate action. In the EOS, the OOD has to call the EOW on the phone (time delay). The EOW could stand his watch in the EOS and thus eliminate the Rover, but a couple of the junior guys could not stand EOW in the EOS. He could operate the plant but he does not know every valve. On the Bridge the MCS-5 can control everything that needs to be controlled. The chilled water reefers and reverse osmosis (RO) water makers cannot be controlled from the Bridge. However, he does not see a need to change the MCS-5 system because you need to do a visual inspection before starting the RO water makers up anyway.

Engineering Plant

The gas turbine starters could last 15 years or 15 starts – it remains to be seen. To save weight, gas turbine filter coalescer towers were not designed into the plant. A fuel oil purifier in each hull would save thousands of dollars and hundreds of hours of labor. There is no stripping capability.

The plant was designed to meet ABS standards [opposed to Navy standards]; therefore, there is no way to sample oil from some equipment. For example, there is no way to sample the oil from the gearbox without crawling under the shaft and removing the drain plug. Therefore, a Jabbsco pump and garden hose are used to extract a sample of oil from the gearboxes.

The main propulsion plant layout is smart and simple, and each side is identical. There is not enough space to work. It is not possible to access half of the equipment and piping associated with the waterjet hydraulic system. If it leaks, we have to live with it.

The auxiliary plant utilizes PVC piping, which is the wrong material.

The ROs are an excellent piece of equipment. The chilled water reefer plants are too automated. The air compressors are subject to frequent mechanical failure. The transfer pumps, oily water separator, and JP-5 system are either fine or really good.

The X-Y crane has finally been fixed due to the efforts of Chief Skinner and Titan. This crane cannot be used at sea. Admiral Cohen said he would have purchased a forklift for Sea Fighter had he known the X-Y crane cannot be used at sea.

The elevator is OK except for its seal. The aluminum ship racks prevent maintenance of a good seal.

Crew Size

The engineering department crew size is adequate to operate the plant, but we are behind on maintenance. If the maintenance support team were functional, they would be an asset. Similar to Coast Guard MAT teams, some are good, some are not.

Is 25/26 people the right size and mix of ratings? A GSE would be beneficial (even though EM1 Szatkowski is very effective). The CHENG acts as the counterbalance to the engineering chiefs. The CHENG needs to be able to read one-line electrical drawings.

Habitability

The berthing spaces on Sea Fighter are the worst he has experienced in 22 years. The bunks are the worst even back to the days when Navy ships were steam powered. The CHENG shares a room with the Comms Officer (two men in a three-man room), and it's still too small. The lockers are also too small. For example, on the trip to Hawaii, the following (extra) uniform items must be carried: service dress khakis, service dress whites, service dress blues, Eisenhower jacket, and two sets of khakis. There is not enough room to carry all these uniform items. Coffin racks with drawers are needed, in addition to larger lockers.

The crew has no place to go while off-watch. This ship is small and gets smaller yet while underway. The only place engineers can really go and hang out with a book is the EOS. The ship is not large enough to justify a khaki lounge or wardroom.

Flight Operations

Flight operations on Sea Fighter are effective even with their 25-person crew size.

Refueling at Sea

It is a huge challenge for the Sea Fighter to refuel at sea, partly due to lack of practice. Sea Fighter refueled from the *Guadalupe* (oiler), which streamed the refueling hose astern and Sea Fighter hooked up to their riser in the stern. Due to insufficient length of hose, the riser was almost destroyed (needed more slack in the hose).

During the transit to Hawaii, we do not intend to refuel. As long as we do not exceed 50 gallons/mile, we should make it without refueling (2,400 miles). We intend to take on every drop of fuel we can squeeze in. Our fuel reserve requirement is 10 percent.

Ride Quality

At 50 knots in 6- to 10-foot seas, the ride is frustrating; it shimmies and shakes and bounces like an airplane flying through bad turbulence. Noise is not an issue. Hearing protection is needed if you cannot carry on a normal conversation. In 6-foot seas, it is a really good ride. Faster is better. The Rover is prohibited from going into engineering spaces in rough weather due to safety concerns (there are no handrails).

Boat Operations

The stern ramp/cradle is a good idea but poor design. We lost a shaft seal on the 11m RHIB while we were using the boat and the Sea Fighter was at anchor. During this period, the boat was being recovered; just as the RHIB's bow engaged the cradle, a wave lifted the boat off the

cradle and then the boat went under the waterjet guard. Petty Officer Ayers ended up in Chief Cacciatore's lap. Eventually a rogue wave will either destroy the RHIB, or someone will get hurt.

The SOLAS boat is not used in heavy seas. The port engine exhaust is a problem during L&R of the SOLAS boat, but the Bridge is reluctant to shut down the port engine.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- The propulsion system on Sea Fighter is outstanding, and the MTUs are bulletproof.
- Recommend the Mark V RHIB. It is 82 feet long, 17.5 feet wide, and 5.5 feet deep; on step it draws 2 feet of water. It is an 82-foot jet ski that does 50 knots.
- Berthing areas need to be redesigned. The original design is poor.
- The crew needs a lounge or Mess Deck in the Mission Bay.
- There is a lack of admin spaces. There is no log office. CIC is underutilized.
- There is not enough storage space for the Galley.
- The Sea Fighter has to carry 12 tons of fuel more in the starboard hull to offset the weight of the SOLAS boat and its associated equipment as well as the Bridge, which are on the port side.
- There is a problem with exhaust fumes in the Mission Bay. This was not a problem before the deflectors (some call them spoilers) were designed by Admiral Cohen and installed forward of the diesel exhaust on both sides of the hull. He thought the diesel exhaust was causing a buildup of heat in the CO_2 room, but this was not really a problem.
- The supply fans for the engineering spaces are aft in the Mission Bay and suck in salt spray generated by the waterjets. No one expected the violent turbulence created by the waterjets. The LCS's waterjets are submerged and should not experience this problem. Demister pads were tried unsuccessfully in the supply fans.
- The Mission Bay can accommodate 12 modules. If we filled the Mission Bay with 12 modules, we would be so heavy we could not transit to San Francisco. We currently cannot take on a full load of fuel because we would be down by the bow and no room to transfer fuel to compensate. With a full load of fuel, our top speed at full throttle would be reduced to 44 knots and we would be subject to wet deck slamming due to reduced wet deck clearance.
- During the heavy weather trials, it was necessary to inspect voids. During these trials, we experienced problems with the seawater cooler on the port side, and the solenoid valve on the starboard cooler was starting to give us problems. We bypassed both coolers because the seawater was cold anyway. This is the second round of failures of these coolers. When the vessel was only 6 months old, a pancake orifice had to be installed to increase discharge pressure.
- Lack of a fuel oil purifier is a problem.

D.6.14 Interview of Enlisted, USN

Background

Previous duty stations included 5 years on the Spruance class Destroyer, *Paulette Foster*. He was promoted from SA through 2nd class petty officer on this vessel. He was also stationed at the Naval Ocean Processing Facility (NOPF), Whidbey Island, working on comms suites for underwater survival ships. He was transferred to USS *Zephyr* (a PC-170) two months after completing "C" school for LAN administrator. He has been onboard Sea Fighter since July 2004.

Duties

- Navigator of the Watch (NOW). The layout of the NOW watch station is excellent. One of the four voyage management systems (VMS) on the Bridge is a problem. Having four VMS systems permits continued operation of the ship in the event one of the four systems goes down. Electronic charts are new to the Navy and eliminate the requirement for paper charts. It is easy to use the commercial radar on Sea Fighter.
- Leading CPO for Comms Department, which includes ET1, IT2, OS3, and CWO Leary, Comms Officer.

CIC

On Sea Fighter, CIC has no radar repeater and is not intended as a secondary navigation capability. IT is more for comms and a central hub for dissemination of information throughout the ship.

Comms

The Bridge has an "X" and an "S" band radar feed. In addition, the Bridge has the following external comms capability:

- 3 UHF/FM (line-of-sight (LOS))
- 1 PRC 117F (non-DAMA SATCOM)
- 1 Harris GRC HF
- 1 VHF Bridge to Bridge
- Centrix/NIPRNET/SIPRNET for RIMPAC
- Crypto gear installed in both hulls (it would be better if this gear were on the Mission Deck)

Habitability

The bunks on the Sea Fighter were designed for the subsurface Navy. The lockers are too small. There are two chief petty officers in each of two rooms.

The Galley/Mess Deck is adequately sized for a crew of 26. The Mess Deck on Sea Fighter is the same size as the Mess Deck on a PC-170. There is 10 days' storage capacity of food for the Galley.

Ride Quality

Water/wind noise is to be expected in a high-speed ship. At 40 knots in 8-foot seas, the ride is smooth dependent on wave period. At 10 knots, the ride is terrible. Rolling is not an issue and never exceeds 10 to 15 degrees. Loitering (or dead in the water) is an issue depending on wave height and direction.

The vessel can be easily turned in high-wind conditions.

Crew Size

Twenty-six people are too few. There are 5 people in the Comms Department and 8 in the engineering department. In the Comms Department we need at least one other communicator and another OS; we have plenty of ETs. In addition, we need 2 more people for crypto comms. We currently have two OSs and two ITs for communicators. We have plenty of LAN administrators due to cross-training.

Small Boat Operations

The stern ramp used to launch and recover the 11m RHIB barely goes into the water, and even slight movement of the ship can result in the ramp emerging from the water. This is a real problem for the coxswain trying to drive up the ramp.

Mooring Operations

Putting mooring line #1 over onto the pier requires a crewman to go outside the ship through the bow hatch and toss the heaving line back to another crewman standing on the fo'c'sle in the opening on the port or starboard side (depending on which way the ship intends to moor). Sea Fighter normally doubles up all lines. Communications with the Bridge (to the linehandlers) is via ICOM radios. However, Motorola makes a better radio.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Communications suite should be centralized – not in individual hulls.
- Crew size should be patterned after PC-170. Sea Fighter has too many officers.
- Certification of comms suite takes too long, primarily because of the way the Sea Fighter's comms suite was designed. The comms suite was installed in September 2005 and an Initial Authority to Operate (IATO) was granted. We are scheduled for full certification in May 2006.
- The TAO watch will be stood by people in the Comms Department. The four qualified watchstanders include the ET1, ITC, OS3, and IT2.

D.6.15 Interview of Enlisted, USN

Background

Was a teacher on previous ships. The Sea Fighter has been and is trial and error. The ship was not built to Navy standards; it was built to ABS standards. The initial expectation for Sea Fighter was for the crew to write all the instructions normally written by the lead ship in a class (with a much larger crew). However, the Sea Fighter did not have the resources to do this.

Duties

- Senior Enlisted Advisor.
- BMC on Mission Deck and Flight Deck. Along with the GM2, BM1, and BM2, responsible for operation and maintenance of the elevator, stern ramp, X-Y crane, anchoring equipment, isolation doors, SOLAS boat and RHIB, small boat L&R equipment, and Flight Deck. The BM2 was seriously injured in a motorcycle accident, and the replacement BM2's fiancée suddenly died, so the BM2 billet on Sea Fighter is currently unfilled. The BMC has been working undermanned for a long time. There is no rank distinction on Sea Fighter due to small crew size; everyone has to work in order to get the job done.
- LSE for flight operations. GSEC Skinner is the backup LSE.
- NOW watch underway.

Deck Machinery

The BM1 is the 11m RHIB coxswain. The GM2 and BMC without additional manpower have successfully lowered the anchor. He goes from one thing to the next all day. On Sea Fighter, evolutions are accomplished with two people where a normal Navy ship would use 15 people.

The X-Y crane is manufactured in Poland, the stern ramp in Germany, and the boat winch in France, to name just a few. In addition, the equipment was not designed to be interoperable. When the ship was delivered, the blueprints, drawings, diagrams, etc., for all the deck machinery were missing. We were given an AEL for a similar piece of equipment on a PC-170 or FFG and told to "make do." This was a real joke, because Sea Fighter is not at all like a PC or FFG.

All the equipment on Sea Fighter is commercial; therefore, the Navy's 3-M system was not usable. The Deck Force had to create and tailor their own program.

We asked questions and received no answers. For example, where is HazMat stowage, and how much is Sea Fighter authorized to carry? No answers.

We had to inventory everything and then find a place to store the stuff. At first we stored everything in Conex boxes, then we moved everything to lockers fabricated and installed in the voids, then funding to build additional storage lockers became an issue.

We wear Coast Guard life jackets and 57-degree exposure suits. These items are Coast Guard and not available in USN stock system. We should take advantage of things the Coast Guard does and the Navy doesn't when it benefits the Sea Fighter. For example, the Coast Guard uses high tie-down straps; we use chains to tie down a helicopter on the Flight Deck.

Small Boat Operations

The SOLAS boat company said that the boat would safely carry 6 people (including a coxswain, boat engineer, boat hook, supervisor, and man overboard survivor). However, in reality the boat can only safely carry 3 people; 6 would tip the boat over. ABS said we only had to have the SOLAS boat and gear on board – that means we do not actually have to use it, so we use the 11m RHIB for recovery of a man overboard.

It takes 1 minute and 45 seconds to lower the boat and 2 minutes and 45 seconds to raise the boat. ABS standards are 6 minutes and 50 seconds to get the MOB in the boat.

The operating controls for L&R of the SOLAS boat are backwards. The SOLAS boat is designed for the boat crew to operate the controls. However, we found it better for the L&R boat crew to operate the controls during L&R, not the boat crew.

L&R of the 11m RHIB is limited to 5 knots max ships speed. The weight of the 11m RHIB is causing the aluminum to shave off; rollers would solve the problem. The BM1 designed the current quick release we use to launch the RHIB that is similar to the method the 87' CPB uses. The RHIB cannot be safely recovered in sea state 4 or 5 due to the ramp coming out of the water. In challenging conditions, timing the approach to the ramp is critical.

Flight Operations

The Sea Fighter is the first ship to ever use a 6-man Flight Deck crew. We are able to get away with this because we have a full AFFF flooding system for the Flight Deck, which we have demonstrated successfully.

We have a 600-gallon capacity freshwater washdown capability to wash a helicopter on the Flight Deck.

Mooring Operations

Six mooring lines are not used on Sea Fighter because she is an all-aluminum boat. Only four lines are used. No spring lines or tugs are ever used while mooring. The OOD can use a portable joystick to operate throttle and steer from the Flight Deck if desired. Three stranded lines, which required 5 linehandlers per line, were provided by the builder. They were replaced with Kevlar lines, which are lighter and stronger and can be handled by one person, and winches are never used.

Line #1 and Line #2 are put over from the fo'c'sle mooring station and lines #3 and #4 from the aft mooring station. The stern ramp on Sea Fighter precludes the use of the outboard mooring bitts similar to the USS *Swift*.

We normally moor port side to the pier due to the location of the port side door access to the Mission Bay. If we moor starboard side to the pier, we must put the gangway on the Flight Deck.

Due to the shape of the Sea Fighter hull, we must use at least two large "Yokohama" fenders in our homeport. This is a problem in strange ports, because we do not take the Yokohama fenders with us when we leave San Diego.

Anchoring Operations

It is possible to put out 150 meters of cable (chain is not used to save weight) in 10 minutes. Readings are in meters instead of fathoms. You cannot free-fall the anchor; it must be paid out fast or slow. Anchors are rigged for letting go. There are no detachable links. There are no swivel shots, just a swivel shackle. As delivered by Titan, the anchor winches were installed backwards.

One anchor holds very well with 150 meters of cable out.

Refueling Operations

We did underway replenishment of fuel once. He actually taught astern refueling at school. The problem is station keeping 600 feet astern of the oiler with 150 feet of hose in the water. Ship speed is 5 knots max.

Habitability

The habitability on Sea Fighter is "not that bad." Only problem is shipriders who intrude on the crew's space (on the Mess Deck, in the crew's head, Crew's Lounge, etc.).

Lockers that have since been installed on the fo'c'sle are a big help. Security lockers were taken off a decommissioned ship.

The Galley uses an open mess style and is fine.

The Crew's Lounge cannot be used as a way to segregate officers and chiefs from the crew because of the small crew size.

Ride Quality

At 40 knots in 8- to 10-foot, seas the ship rides terribly. Movement is not so bad, but wet deck slams are disconcerting. Slamming is experienced in seas in excess of sea state 5. The ride is especially poor when going slow, and it depends on sea direction.

At 40 knots in 5- to 6-foot seas, the ride is fine – no problem. At 12 knots, the speed at which we expect to transit to Hawaii, he expects the ride is going to be bad. He is dreading the trip out due to expected slow speeds.

At 25 knots, it is hard to tell we are moving; it is similar to 15 knots on an amphibian.

Mission Bay

Maximum capacity for the Mission Bay is 12 mission modules, a HUMVEE, and two 11m RHIBs.

The X-Y crane is currently running well; it needs to be run frequently. It is a one-of-a-kind, designed for use in a warehouse, not on a ship. Underway you can't use the X-Y crane because you can't control sideways (port and starboard) movement.

The elevator works great. However, it does not lower flush with the Mission Deck. The platform is 1.5 feet above the deck at the lowest position, which presents a real problem getting heavy loads on or off the platform. We have two pallet jacks; we could use an electric 4,000-pound-capacity jack.

The side door on the port side of the Mission Bay is the normal means of accessing the ship via a gangway. This door works very well.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Crew size is too small. Need 40 or so who are well-rounded and able to do multiple jobs/tasks.
- Qualifications – Plank owners went through pipeline training, but due to OPTEMPO don't have time to do on-the-job training and learn the operation of Sea Fighter's equipment.
- Two months and longer to fix things that are broke is unacceptable.
- Need to follow the concept "One company, one provider." On Sea Fighter, the low bidder was used for everything, resulting in equipment coming from numerous providers, and none of it is interoperable.
- Vendors come onboard and change something with proprietary software on their laptop and leave. Frequently they have to be called back to fix it again because the ship can't do it themselves.
- There are four 50 caliber machine gun mounts, but only three work.
- Sea Fighter needs a hangar – give up one landing spot.
- Elevator should be bigger.
- Sea Fighter would be ideal for AMIO with the vessel's speed and the large Mission Bay for holding migrants.

D.6.16 Interview of Enlisted, USN

Background

Enlisted, USN, and CWO Leary are the only two crewmembers who live onboard the Sea Fighter.

Duties

- Engineering Department (CHENG + 8); Enlisted, USN, is one of the 8. Engineers are assigned a primary responsibility; for example, the MK1 is assigned to auxiliary equipment, the EN1 to the main diesel engines, and the GSM1 to the gas turbines; however, everyone must help one another due to the small crew size.
- EOW watch underway.

Preventive Maintenance

Engineers are assigned very few collateral duties due to the maintenance requirements they must accomplish. The ashore Maintenance Support Team (MST) is supposed to help accomplish the preventive maintenance, but they don't. The MST orders all the supplies we need, but the crew of the Sea Fighter has to do all the work and the MST simply calls and gives them the credit card number. The Sea Fighter did not get the support they were supposed to receive from RSO San Diego or anybody else. The MST is preoccupied with building the Littoral Combat Ship (LCS).

Part support from Germany to repair and maintain the ramp has been terrible. We had to go overseas to get fuel oil filters the gas turbines which kept them out of commission for weeks.

Storage for engineering spare parts was not designed into the ship. A red Conex box on the Mission Bay is being used. Cabinets that fit through the scuttles are needed.

Engineering Watches

EOW stands his watch on the Bridge. This works well, but working in the dark at night takes some getting used to. The EOW controls the plant from the Bridge, but Rovers are needed to control the air-conditioning machinery and reefer machinery locally. Emergency stops on generators and seawater pumps are controlled by the EOW on the Bridge. The lube oil pumps have no remote control. EOW is also an extra set of eyes on the Bridge. The position of the EOW on the Bridge is fine. The original design of the Bridge did not call for the TAO console to the right of the EOW. The chairs on the Bridge do not swivel; they move electrically forward and aft. In the even of a fire, the EOW must wait for his chair to move aft before he can get to the vestibule to trip the CO_2 flooding system. Life rafts are not easily accessible either.

Rovers access the engineering spaces, which are tightly packed with machinery. Maintenance in engineering spaces requires lifting deck plates, and the shafts are under the deck plates. An engineer manually engaging or disengaging the shaft coupling to the gear box is stuck on the box because the deck plates have been removed. The Rover checks the engine room periodically for leaks; hydraulic leaks in particular are common due to the vibration. On one occasion, the Rover discovered 1,100 gallons of seawater in the bilge.

The original junior officers and original CO went to high-speed school together. Now, with new junior officers and a new CO, we have to start all over.

Engineering Plant

Two generators are always on the line (one in each hull). They are operated from a single switchboard. There is no emergency generator. The generators are lightly loaded (because of the requirement to run two); therefore, fuel dilution becomes a problem, resulting in the need to change oil frequently. There was supposed to be a contract with a vendor to change oil, but in reality the crew is on their own.

There is plenty of fresh water on Sea Fighter due to the reverse-osmosis water makers, which work great. There is a pressure washer and garden hose and 1,000 gallon freshwater tank dedicated to washing helicopters on the Flight Deck.

Damage Control

There are enough self-contained breathing apparatuses (20) to man two hose teams.

The firefighting philosophy on Sea Fighter is to fight a main space fire with the installed CO_2 flooding system, and if that does not extinguish the fire, the crew abandons ship. Depending on the compartment, you either have 30 minutes or 60 minutes to extinguish the fire before it breaks through into the next compartment. The firefighting philosophy on Sea Fighter is not suitable for a warship.

Steel doors on Sea Fighter are installed in aluminum bulkheads, which simply makes the bulkhead the weak link. The aluminum bulkheads on Sea Fighter are only 4 to 5 millimeters thick. This would not be acceptable in the Persian Gulf.

Refueling Operations

The process for replenishing lube oil involves transferring 55-gallon drums from the pier onto the elevator on the Flight Deck with a crane. Then they have to be manhandled with pallet jacks over to the lube oil risers inside the quarterdeck.

It is easy to refuel JP-5 or marine diesel in port. At sea we have hooked up for refueling through the stern on one occasion. We are not sure how long it would take to refuel with this astern refueling method. However, we think we could take on 80,000 gallons in one hour through a 4-inch hose. With a 2.5-inch hose with a camlock and gravity feed, it takes 4 hours to take on 40,000 gallons.

There are six storage tanks and two day tanks for marine diesel fuel, which the generators, main diesels, and gas turbines all use. The ship is designed with the storage tanks amidships and forward of amidships (on port and starboard sides). This creates a problem if you need to shift weight aft. This problem is compounded by the fact the Mission Bay modules are also located amidships and forward. Therefore, we never fill the forward two diesel storage tanks, which reduces our virtual capacity for fuel from 160,000 gallons to 110,000 gallons. A possible partial solution is to replace the existing voids below the gas turbine modules with fuel oil storage tanks and move the lube oil and dirty lube oil tanks forward.

Habitability

The privacy gained through three man staterooms is a plus; however, the bunks were designed by a submariner and are so small you can't sit up to read. The Sea Fighter did not receive standard Navy bunks. Each stateroom has a LAN drop, but there is no room to work in the stateroom, so the drop is useless. Officer staterooms at least have a desk in their rooms, but not the crew.

There is one computer in the Crew's Lounge and one in the ship's office, and that's it! The first CO turned the wardroom into the Crew's Lounge. The crew would like a DVD player for the Mess Deck TV and an X-Box hooked into the Crew's Lounge TV. Currently we have 8 mm films and a projection screen from NWR; however, the BMC has to keep them locked up, so if he is not onboard, you are out of luck.

Everybody helps out in cleaning the Mess Deck and Galley. The offgoing watch cleans the Mess Deck. Heads are nice; however, the showers should be equipped with handrails to help the crew deal with ship movement underway.

Ride Quality

At 40 knots in 8-foot seas, the ride is terrible. The ride is better at high speeds than low speeds. Wet deck slamming is common in heavy weather. If you ride in the trough (to avoid wet deck slams), the ship rolls excessively. The two hulls interact with the wave swells and cause a herky-jerky, unpredictable ride.

Small Boat Operations

The launch and recovery of the 11m RHIB is safe unless in heavy seas. The design of the stern ramp is very poor; it is too steep and floods the boat. It does not go deep enough into the water, so the end of the ramp emerges from the water as the ship pitches. The coxswain has to power the boat off the ramp, which is hard on the waterjet buckets. The coxswain has to power the boat up the ramp at full throttle, which does not permit any cool-down time for the engine. We started with a brand-new RHIB one year ago, and so far the trim tabs have had to be replaced and the waterjet buckets fell off. The MST repairs and maintains the RHIB.

Crew Size

The Sea Fighter was a big experiment for a minimally manned crew. They are trying to determine how few crew you can get away with. Twenty-six persons are enough to operate the ship, but without maintenance support, 26 persons are not enough. If the ship were to be built for multiple missions (and a 26-person crew), it would break down excessively due to lack of maintenance. The crew needs to do the maintenance in port so they are familiar with the machinery and able to fix it underway when it breaks. This means you need a larger crew.

A twenty-six-person crew is not enough to sustain day and night underway operations of the ship <u>and</u> conduct flight operations and small boat operations. The 26-person crew could not do two to three boardings per day and launch and recover helicopters during the day.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Shoreside maintenance support is needed.
- Berthing for details, testers, and shipriders is inadequate, so the berthing module was

provided. However, the berthing module has no privacy and no red lights.

- Ship design should be limited to one or two companies max. For example, Sea Fighter has equipment provided by GE, Woodward, MTU, Kamewha, Simmons, and Rolls Royce, to name but a few.
- Electronic controls are a problem. Because tech reps will hook in with their laptops and proprietary software and make tweaks and adjustments, only they can fix the equipment.
- Titan cut corners wherever they possibly could. They should never be allowed to build another ship.
- The ship has to conform to multiple standards and certifications provided by Navy and ABS. Nichols and Titan have different corporate philosophies. Nichols started building the ship before the design was completed and without an understanding of what the Navy would require on top of ABS requirements.

D.6.17 Interview of Enlisted, USN

Background

The Coast Guard contingent (10 crewmembers) showed up in September/October; they were going to be onboard one year. Extensions were certain, and of course that happened.

Duties

- EOW watch underway. There are 9 engineers in the Engineering Department. The goal is to qualify them all for either EOW or Rover. The engineers cannot afford to help stand the comms watch. The layout for the EOW on the Bridge is great except for night watches. There is no light available to maintain the log. There is a voyage recorder, but we also maintain a written log. The EOW watchstanders now carry a little light with them, which they use on the Bridge at night to write their log. The EOW serves as another set of eyes on the Bridge. The ship was designed for the EOW to be on the Bridge at all times, so we had to create the Rover watch to make rounds line up auxiliary equipment and check things per the EOW direction, since he can't leave the Bridge. The Rover is available on his cell phone and makes hourly rounds.
- The two gas turbine techs on this ship take care of 2 auxiliary spaces, both gas turbines, and the oil lab. This amount of work would normally be assigned to 7 people on another Navy ship. A maintenance crew in port to help out would be ideal. The MST in San Diego cannot be relied upon because of their attitude. The MST is supposed to support the Sea Fighter and order parts. Nobody on the MST has ever helped him out with his work. When the 10 Coast Guard guys leave, we are supposed to get 5 MST guys to take their place.

Engineering Plant

He really likes the unmanned engineering spaces on Sea Fighter. It is easier (on the crew) to be underway than in port. The consoles on the Bridge permit transferring fuel, opening and closing valves, etc. However, alarms were common (especially when the ship was new), and the "fuel system alarm" is not specific enough to determine the problem.

He does not like the fact that sewage and freshwater piping systems on Sea Fighter are ABS plastic (prefer metal piping).

The reverse-osmosis water makers on Sea Fighter work very well; we never run out of water. On one occasion, we accidentally dumped one whole tank of fresh water (of two), and it only took one hour to catch back up.

The system is so fast that normal casualty control procedures do not apply here.

Finding time in port to accomplish preventive maintenance is a problem.

Ride Quality

At 40 to 50 knots, the ship is super-loud.

The ride quality at 40 knots in 8-foot seas is not good, and wet deck slams are frequent. When wet deck slams were first encountered, the crew was nervous. Seasickness is an issue on Sea

Fighter. At slower speeds, the direction of the waves makes a difference. Drifting in less than 8-foot seas causes the ship to move all over the place.

Part of his job is to test oil samples from the machinery. Grabbing a sample of oil is usually not a problem, but sometimes, due to the ship movement underway, it is not possible to run the test.

Exhaust fumes and diesel smells depend on the relative wind. A stern wind at slow speeds fills the ship up with exhaust fumes and diesel smells.

Habitability

The three-man staterooms are OK, but they are a little small, but they are nicer than other large ships. The berthing area for the auxiliary gang includes 30 racks on a CGN nuclear cruiser.

The Mess Deck/Galley works, but it gets a little hectic with 19 shipriders. With this many shipriders, it was really crowded, and the crew had to wait 30 minutes for a seat on the Mess Deck. Normally you never have to wait for a seat.

The Crew's Lounge is the crew's only recreational space. Chiefs and officers pick up a broom and help keep the ship clean. You have to do this with a small crew like Sea Fighter. Most of the time you can catch a movie in the Crew's Lounge, but it is also where meetings take place; sometimes these meetings step on the movie.

Ship Safety

There is an ABS requirement that this ship continue to float even with one hull flooded. The crew generally believes the ship would float with one flooded hull.

At 50 knots, a "crash back" could result in someone getting hurt, but the crew typically believes they are safe on Sea Fighter.

Small Boat Operations

From the 11m RHIB, the ship looks huge. He was trained on a 7m RHIB from an 87' CPB. The launch and recovery operations are safer on the 87' than Sea Fighter because of the possibility of the boat being trapped under Sea Fighter's waterjet guards. The boat can be launched and recovered at speeds not exceeding 5 knots.

A vertical design that integrates the elevator with the stern ramp would be better. Admiral Cohen, ONR, visited and said if another ship like Sea Fighter were to be built, the elevator and stern ramp would be redesigned.

Refueling Operations

The Sea Fighter took on 2,000 gallons of JP-5 in 30 minutes (in port).

The Sea Fighter conducted a dry run for underway replenishment of fuel via the stern. No one got hurt. The ship is capable of taking on a high volume of fuel.

Flight Operations

He is in charge of fuel quality. The JP-5 system dedicated to helicopter refueling is a small system. He went through training for the 6-person Flight Deck crew (two chock-and-chain, one LSE, and three hot suit men). There is also an HCO in the tower controlling the operation.

There is nobody standing by; in the event of a fire, the AFFF flooding system is used and the LSE turns into the scene leader.

<u>Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?</u>

- The engineering plant is good.
- Need more crewmembers (sometimes OK sometimes need 5 more people).
- Stern ramp needs to be redesigned.
- The MCS system should be retained.
- Finding time to do preventive maintenance in port is difficult.
- Two gas turbine techs on this ship have the work equivalent to 7 people on a normal Navy ship. A maintenance support team that would actually help in port would be ideal.

D.6.18 Interview of Enlisted, USN

Background

The ET1, HM1, and OS3 are all from Mississippi. Has 16 years' Navy service (4 years to go to retirement). Previous duty stations included Memphis, TN; Pascagoula, MS; and Meridien, MS. After retiring from the Navy, he will return to Mississippi, where his dad has given him 4 acres of land.

He has "restless leg syndrome," which feels like he has a 25- 30-pound weight on his legs and ankles while underway.

Duties

- HM1 full time.
- NOW watch underway.
- HCO during flight operations. He is the only qualified HCO onboard.
- Mooring Stations. He provides a safety briefing for all shipriders upon getting underway. During this briefing, he apprises them of abandon-ship procedures and the availability of Dramamine (to deal with seasickness). He also hoists the National Ensign and international call sign and shifts colors.

Crew Size

His biggest complaint is that the Navy downsized this crew due to budget concerns. He feels it is not feasible to replace personnel with technology. We are expected to operate like the Navy but without the number of personnel normally required. The Navy should not reduce manpower to compensate for budget cutbacks.

Flight Operations

There is an envelope of allowable pitch and roll that permits flight operations. The ship must choose a heading and speed to move the Sea Fighter into this envelope.

There is no mast or large superstructure to block the wind across the Flight Deck.

He prefers to land the helo on the aft landing spot to avoid any possibility of the rotor hitting the top of the elevator.

The helo control station is "fabulous," and the layout and access to the equipment is logical. Everything he needs to function as the HCO is either right there or a phone call away. The OOD controls the Bridge-to-Bridge radio used to communicate with the helo.

Bridge

The visibility from the Bridge includes a large blind spot on the starboard side aft due to the vestibule that provides access to the Flight Deck.

Sick Bay

A naval ship always needs a space designated Sick Bay. He has the best working environment of anybody on board. Sick Bay includes an exam table (not a bunk) where minor or major surgery would be performed with the patient on a stretcher.

His plan for medical stores was adopted, which was based on surface PC requirements. The Sea Fighter is equivalent to an ambulance that stabilizes the patient, provides emergency treatment, and transports the patient as quickly as possible to an appropriate treatment facility.

Ride Quality

Based on experience, he knows who to expect to get seasick. Noise is a contributing factor to seasickness. The best treatment is to put the seasick person in a cool, dark, quiet environment.

The worst thing is an accumulation of cooking fumes on the Bridge and gas turbine/diesel exhaust fumes in the aft mooring station.

You can’t see outside the ship except on the Bridge. The aft mooring station and weather decks are off-limits during high-speed operations.

At 40 knots in 8-foot seas, the ride is great regardless of sea conditions. But at slow speeds in bow-on or beam seas, you get a jerky motion and an uncomfortable rocking motion. Drifting without power in flat calm conditions, the ride is fine. If it is not calm, the ride while drifting depends on sea state and direction. He has not had to administer treatment to a patient under adverse ship motions. He anticipates he would ask the OOD to change heading if this was needed.

Habitability

The carpeting on the Mess Deck is a big issue and against Naval Ships Technical Manual (NSTM) requirements. The carpeting was installed to deaden the noise. The volume of the freezer and dry stores is reversed. Dry stores should be larger, and the freezer should be smaller. The size of the Mess Deck is suitable for a 26-person crew.

The door to the AFFF room has been replaced twice due to ship racking.

Three-man staterooms for crew’s berthing areas are great but too small. He would not give up the privacy that comes with three-man rooms. HM1 and CS1 are roommates. The vertical clearance between the bunks is normal but short, and the lockers are too small.

He is pleased with the heads, especially the fact that the toilets and showers are separated. Water hours are never needed on Sea Fighter.

The Crew’s Lounge is “fabulous.” There are usually 5 people on the Bridge and 5 people sleeping, leaving only 16 people, which is not enough to fill the room.

Small Boat Operations

He is impressed with the functioning of the stern ramp. It was not designed for the weight of an 11 m RHIB. The Sea Fighter crew had to redesign it.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Sea Fighter would be ideal for providing humanitarian assistance in Katrina-like scenarios.
- The elevator should be positioned aft to better deal with RHIB L&R, lowering helos into the Mission Bay, and for taking on cargo.
- Sea Fighter needs to be armed with more firepower than 50 caliber machine guns for counterdrug operations. The Sea Fighter could not defend itself against rifle propelled grenades (RPGs).
- Sea Fighter is not suitable for mass migrant operations. Twenty-six people are not enough to sustain 200 migrants for two weeks. The best place for migrants is on the Mission Bay, where they can be isolated.
- Crew size is too small. It started out to be 36, went to 16, then ended up at 26; 36 may be adequate, and 40 would be even more adequate.
- Don’t cure budget problems by reducing crew size.
- Everybody should be cross-trained, but Sea Fighter crew is too thin to effectively cross-train.

D.6.19 Interview of Enlisted, USN

Background

Previous duty stations have included seagoing tours on a DDG and a LPH. He would like to learn engineering watches.

Duties

- The only assigned cook. This is a problem. Need at least one more person to help the cook. Other departments rotate, providing a person to help me. He is able to keep the crew happy with the variety of food, quality of meals, etc. The crew gets tired of pre-prepared meals. MidRats are prepared from leftovers from dinner.
- Boat handling crew for L&R of the SOLAS boat. He handles lines during L&R of the SOLAS boat. He considers this operation unsafe.
- Stretcher bearer during General Quarters

Galley

The Galley was designed for feeding a 26-person crew, but typically we are preparing meals for 35 to 50 people (crew + shipriders). The Galley is adequate for feeding even this larger number of people. Cabinets in Galley do not latch securely, so tape is used.

Preparing meals underway in rough weather is an issue for soup but otherwise not much of a problem. The refrigerator is too small and should be half the size of the freezer, which is too big. Based on the amount of food that can be carried, it is possible to feed the crew of 26 for 30 days (milk would run out). There is no milk dispenser.

Migrant Operations

If the Sea Fighter were to take 200 migrants onboard, would it be possible to feed them? Answer: Only with MREs (Sea Fighter does not carry MREs).

Mess Deck

Carpeting is a problem. HM1 inspects it daily. Terrazzo should have been installed, as in most other ships.

Garbage is stowed on the Mission Bay just forward of the berthing module.

There is no assigned mess cook, so cleaning up after meals is an issue. Currently the offgoing watch helps me clean up. The crew is very good about helping me out. The Sea Fighter has a commercial dishwasher and uses dishes, not paper plates.

The cook serves everyone because there are no hot wells. He ordered and received a hot plate.

Habitability

The three-man crew staterooms are very cramped especially the lockers. It is not possible to stow all the uniforms we are required to carry. Two people can get dressed at a time in the room, but not all three.

The existing Crew's Lounge originally was going to be a wardroom. It is not big enough. Shipriders go into the Crew's Lounge, which intrudes on the crew's use of the lounge. The CO allows the crew to eat their meals in the lounge as long as they clean up after themselves.

Ride Quality

He has never been seasick. It is difficult to prepare for the jerky ride you get on Sea Fighter. Faster is better than slower in terms of ride quality.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Need more than one cook. Need more than 26 people.
- Need an SK. Without an SK and you need to take on stores, who does the paperwork?
- Need increased storage.
- Carpeting should not be installed in the Mess Deck.
- Need hot wells on the serving line.
- Need a mixer and a milk dispenser.
- Need a larger refrigerator.
- Need a small refrigerator on the Mess Deck so that the Galley can be secured at night.
- Spacing between Mess Deck tables is too tight.
- Need a dedicated mess cook.

D.6.20 Interview of Enlisted, USN

Background

Enlisted, USN, is from Lawrence, KS. His first ship was an aircraft carrier, where he was one of 30 quartermasters. On the carrier, he cleaned heads and berthing areas. He was a 3rd class petty officer on his next ship, the LSD 36, where he was one of four quartermasters. On this ship he had the added responsibility of damage control. His chief petty officer on the LSD convinced him to stay in the Navy. He received good evaluations, got married, and had a son. Then he was transferred to a reserve command in St Paul, MN. He was there for two years when he received orders to Sea Fighter. He went to Whidbey Island as part of the original (plank owner) crew. He was the second person to report aboard (the first CO was first). He has been onboard Sea Fighter two years and has been offered the LCS. He may be interested in going to Virginia, but he is also interested in taking the orders to the LCS. He now has two boys (6 and 2 years old). This assignment on Sea Fighter has been both helpful and hurtful (to his career). He has received awesome evaluations, and it has been an awesome learning experience. However, he does not think this knowledge will be appreciated or even expected at his new command.

He believes that more responsibility makes a better sailor. Most men in the fleet simply want to determine the ship's position and turn over the watch to the next quartermaster. The Navy is going to a paperless ship by 2005, now 2009. However, it is not being introduced to the fleet in a smart way.

Duties

- NOW watchstander. The layout is great, with plenty of redundancy. The NOW is somewhat redundant with the OOD, but you need one who is responsible. At 50 knots, you need a qualified radar operator to act as the lookout.
- Break-in OOD.
- SAR swimmer.
- Command Fitness Leader.
- Qualified Coxswain.
- Qualified EOW. The EOW silences alarms and sends the Rover to investigate. The EOW could also be a Navigator. Electronic charts overlaid with engineering alarms would permit one person to act as both NOW and EOW. Ninety-eight percent of the time, the EOW does nothing more than silence the high freezer temp alarm, but it is the best thing in the world to have the EOW on the Bridge.
- Qualified Rover.
- Part-time cook.

Navigation Equipment

ECDIS is a great aid to navigation. ARPA is a great tool that is underutilized on Sea Fighter. He is personally familiar with quartermasters at Afloat Training Group (ATG), which he receives help from occasionally.

The Sea Fighter has both an X-band and S-band radar. As long as you know how to tune a radar, there is no reason to be nervous in reduced visibility or heavy fog.

While conducting high-speed operations, it is necessary for the OOD and NOW to coordinate with each other so that one person is always “eyes up” (looking out the Bridge windows) and the other person is “eyes down” (looking at the radar displays and other instruments on the console). With the OOD acting as pilot and the NOW acting as copilot during high-speed or low-visibility operations, plus the EOW acting as a third set of eyes, and with the redundant equipment available on Sea Fighter, you are all set.

The first CO told him that he was onboard Sea Fighter to prove the Navy does not need him (a quartermaster) anymore.

The track steering feature of the autopilot should be used. The Navy is a little slow in taking advantage of this type of technology.

Some quartermasters can make the transition to paperless charts; others cannot. The Navy should identify a subject matter expert who knows it inside and out and let them conduct the training of others. It takes four hours to update charts. The Navy has eliminated any possibility of the Russians taking over with DNCs.

Flight Operations

It would be beneficial to trade in one landing spot on Sea Fighter for a hangar. The Coast Guard does not need two helicopters on a single ship. On second thought, maybe at a chokepoint, a Sea Fighter-like vessel with two-helicopter capability would be of benefit. In the conduct of fisheries patrols, multiple simultaneous boardings is a need that two helicopters might be able to address.

The Coast Guard either deploys with a helo, or it acts as a lily pad. One option is to fold the blades, put it on the elevator, and drop it into the Mission Bay.

Small Boat Operations

The stern ramp is a terrible piece of equipment. It is small and dangerous. The ramp needs to be redesigned. Launching the boat is not too bad, but recovering requires the OOD to be “on the dime,” and timing the approach to the ramp is critical. The QM1 agrees with the BM1 (opposed to the XO) that L&R of small boats should follow strict procedures religiously step by step.

Crew Size

You have a multitude of duties. Is the Sea Fighter overmanned with a 26-person crew? Answer: There are too few people for general quarters and too few people for flight operations. Every Coast Guard person in this crew is a stellar performer. Our OPTEMPO does not permit a lot of drills, but the Coast Guard is not filling in every opportunity with drills. The Navy should count every boat launch.

We need another permanently assigned cook.

Habitability

Three-man staterooms do not have a lot of room for dressing, but if you carefully pick your roommate, it works out well.

There are no issues with the head facilities on Sea Fighter.

There are no work spaces, only watchstanding spaces.

Ride Quality

The Sea Fighter was made to go fast. The pilothouse should be on the centerline. They were going to put a catapult on the starboard side to launch UAVs, so they offset the pilothouse to port. The pilothouse on Sea Fighter is spacious.

The ride quality at 10 knots is bad. The ride quality is great during high-speed operations on turbines with the ride control system on. Ride quality is poor when the ship loiters, even in 3-foot seas. At speed, 8-foot swells are OK, but ride quality is dependent on wave period.

Mission Bay

During AMIO, the Coast Guard encounters hundreds of migrants that are typically held on the Flight Deck of a cutter for 1 to 2 days. How would the Sea Fighter handle this scenario? Answer: Put them in the Mission Bay where you can control the climate and the migrants. In addition put a 12-gage shotgun in the hands of the ships force who are guarding them.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- Manning is usually not the issue
- Chain of command for “topsiders” (not engineers) is not clear. How does Comms fit? It is not part of Ops? The organization on Sea Fighter is “broken,” and it’s not obvious how to fix it.
- A blue and gold crew concept would be appropriate for the high OPTEMPO of this ship.
- Navigation system is great – would not change a thing. Perhaps combine the EOW with the NOW.
- Don’t change the chemistry a crew builds up. The loss of the Coast Guard crew will alter this chemistry. “In October a major change occurred in the wardroom; and the loss of the Coast Guard crew will be another disaster.” Need to keep the crew together.

D.6.21 Interview of Enlisted, USN

Background

Previous duty stations have included 3 to 4 ships, including the *Kansas City* and a 135' ACL. He would like to stay on Sea Fighter to finish his sea tour. He would like to see the Coast Guard stay until October, but he knows they are leaving in August.

Duties

- EN1 in the engineering department.
- EOW watch underway. He is used to standing watch in the engine room; now he stands his watch on the Bridge. This means you have to be in uniform, act professional, etc. The EOW cannot leave the Bridge; therefore, you do not have full awareness; you can't see flooding, for example. Given the split plant between the two hulls, it probably makes sense to stand the watch in the Engineers Operating Station (EOS). If the EOW could leave the Bridge, he could be the Rover and you could eliminate the EOW watch.
- Boat engineer for MOB, flight operations, and other special evolutions. The BM1 and EN1 muster on the Mission Bay, then they go to the Mess Deck to standby. He prefers the 11m RHIB to the SOLAS boat.
- Local waterjet operator during special sea and anchor detail (in the EOS).

Engineering Plant

The layout of the engineering plant is such that if you lose one waterjet you lose the whole shaft. There is inadequate space to access and work on the machinery.

The gas turbines require a 5-minute cool down after operating for one hour. After 5 minutes, you can restart the turbines.

Preventive Maintenance

We use the SAMMs system not the Navy's PMS system. The SAMMs system is less specific than the Navy PMS system. SAMMs is OK for civilian ships but not military ships, which need the detail included in the PMS system.

The Maintenance Support Team in San Diego that was supposed to support us are useless. There is only one EN1 on that team that can be trusted. The MST is a waste of manpower.

Small Boat Operations

Launching the 11m RHIB is generally smooth; recovery depends on the coxswain. The Cummins engine in the 11m RHIB is OK. However, it is not possible to accomplish preventive maintenance while the boat is in the cradle (the lowered mast blocks the hatch to the engine).

Habitability

Three-man staterooms are way too small. You can't get out of your bunk if someone else is standing in the room. The heads are OK. The Mess Deck is OK; it is big enough for this size

crew. However, during our last transit we had 40 people onboard counting shipriders; the Mess Deck is too small for this many people. The food is not good, we need a better cook.

Crew Size

Admiral Cohen pushed a crew size of 26. However this is too small. You cannot go on leave unless you find someone to take your spot in the in port duty section. Need at least 40 persons, or go to a blue-gold crewing concept similar to the USS *Swift* and LCS1.

Ride Quality

At 50 knots in 6-foot seas, the ride quality is unknown because he has not experienced that condition. At 40 knots in 6-foot seas, the ride is smooth. At 15 knots in 6-foot seas, the ride is bad and you get tossed from side to side. At 5 knots in rough seas, you also get tossed around. At 40 knots there is a high noise level, and wind whistles through the doors.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- The EOW should stand his watch in the EOS.
- The staterooms are too small. They would be OK as two-man rooms.
- Need more room in the engineering spaces to accomplish maintenance.
- No problem with the generators, MTUs, or gas turbines. The MTUs in particular are great.
- Not sure if the waterjets should be retained or not.
- Stern launch should be replaced with an elevator.
- The SOLAS boat should be eliminated. Swinging out on that single point davit is dangerous and scary.
- The Crew's Lounge is fine for a crew of 26, although it would be too small for everyone at one time.
- The MCS-5 system is OK; the ICAST system is terrible.
- A crew of 26 persons each in a blue and gold crew concept would be perfect.

D.6.22 Interview of Enlisted, USN

Background

Has been in the Navy 6 years, with previous duty station in Norfolk, VA. He believes this ship must be designed for the Coast Guard because the Navy would operate it with a much larger crew. One good thing about a small crew is that everyone learns multiple jobs.

Duties

- Stand watch underway as Engineering Rover
- Breaking in as EOW
- Boat engineer for small boat operations
- Engineering Duty Officer (EDO) in port
- Works on auxiliary equipment opposed to propulsion equipment
- Chock-and-chain gang for flight operations (and refuels helos)

Engine Room Arrangement

The engine room (containing the main diesels and ship service generators) are pretty cramped. When the vessel is operating at high speeds, it is noisy and there is a lot of vibration. This causes fittings to loosen and eventually leak. The main diesels work great.

Refueling

In-port refueling is superior to other Navy ships because it is easy to haul the hoses on Sea Fighter. It typically takes two hours to replenish JP-5 and 4 hours or less to replenish diesel. Helos are refueled cold, not hot.

Habitability

Berthing areas are too small for three people, probably OK for two. The CS1 is the only cook. No problem with fresh water – there is plenty. The Mess Deck and Galley are correctly sized for 26 crewmembers. The wardroom was converted to the Crew's Lounge, which is the only place the crew can watch movies. The fitness equipment is located in the Mission Bay. The Mess Deck and Crew's Lounge are noisy at high speed.

Ride Quality

At high speeds the vessel tends to pitch not roll, and slamming occurs in higher sea states. The ride at slow speeds (15 knots or less) is terrible. In rough water, the ship movement is unpredictable and not smooth. Loitering or very slow speeds, the ride is terrible.

Small Boat Operations

The stern ramp comes out of the water at speeds of 5 to 10 knots. The coxswain has to time his approach to ensure the ramp is in the water when the boat passes over the end of the stern ramp.

He was boat engineer in two launches/recoveries of the SOLAS boat, which he characterized as scary but safe. The boat swings a lot on the single point davit. One bucket failed on the small boat last year.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- More than one assigned cook.
- Had a problem with pay, and no admin person to help fix it.
- Better ride control; current system works sporadically.

D.6.23 Interview of Enlisted, USN

Background

His last ship was a Destroyer. He is hoping to go to Norfolk on the USS *Ross* as his next assignment. The detailer owes him a favor. He took the Sea Fighter when the detailer was looking for a GSM3. Now he wants to go to Virginia to see his child. On July 7 his contract is up. His new ship may not want him due to the risk involved. He is willing to shift rates from GSM3 to EN3, although he would prefer to stay GSM3. The EN rating is wide open, and had he chosen the EN rating he would be an EN2 today.

We are proud of the fact that we worked together and got this ship underway. Hopefully the next crew will benefit from what we in the original crew accomplished.

Duties

- GSM3. Work with the GSM1 and GSEC to maintain the gas turbines, auxiliary space #1, and auxiliary space #2. Responsible for preventive maintenance as directed by the GSM1. The GSM1 gave him responsibility of oil king.
- Oil king. Sample and test (clear and bright) diesel fuel (main diesel, ship service generators, and gas turbine engines), JP-5 (helicopter fuel), lube oil (main propulsion machinery), and hydraulic oil (waterjets). The port waterjet had water in the hydraulic oil, which was the reason for our recent drydocking. The oil level did not rise after adding 30 gallons of hydraulic oil to the port waterjet.
- Rover watch. Takes direction from the EOW. Makes hourly rounds to check bilges, listen for unusual noise, etc. He was the one who discovered the water in the port waterjet hydraulic oil. The Rover continues to be the Rover during high-speed operations. The Rover conducts a visual inspection of the gas turbines after they have been started by the EOW.
- Local control of port inboard waterjet for Special Sea and Anchor Detail. Used to be linehandler. He communicates with the Bridge via walkie-talkie with headset and the engine room phone as a backup. Comms from the Bridge is never clear due to high noise levels.
- JP-5 pump room operator for flight operations.

Engineering Plant

The Sea Fighter does not have a fuel oil purifier. Fuel tests show that the fuel is clear but not bright. The fuel barge sometimes brings us dirty fuel. The dirty fuel stays in the tanks and goes to the engines. The coalescers on the gas turbines need to be cleaned every two weeks. The ship definitely needs a fuel oil purifier. The self-cleaning filters get overloaded with dirt to the point they will not rotate and require manual cleaning. The filters on the storage tanks require changing every week or two due to a high “delta P.”

The gas turbines are reliable; however, they accumulate lube oil in the module. The GSM1 complained to no avail. He has to clean the modules. The LOP for the port gas turbine is not working. Tried rebooting, but it didn’t fix it.

It is very difficult to clean the bilges in the engine room.

The oil lab is well equipped with everything he needs, and he considers it to be big.

Flight Operations

There is nothing wrong with the setup of equipment in the JP-5 pump room. The hatch is heavy, and the hold-open device is dangerous. Except for the hatch, the helo refueling operation is safe.

Habitability

The Crew's Lounge (previously the wardroom) is OK to watch movies, and it builds camaraderie. The new X-Box is in the lounge; the old X-Box went to the Mess Deck.

He has never used Sick Bay.

He likes the three-person staterooms, even though he has the smallest room due to the presence of pipes in his room. He appreciates the privacy of a three-person room, and it's a good place to hide from the CHENG.

The heads are awesome.

Ride Quality

At 50 knots in an average sea state, the ride is good. Usually faster is better. At 5 to 10 knots, the ride is bad. Sometimes during Rover rounds, he gets seasick; there are usually handrails to hold on to.

Small Boat Operations

Do you feel comfortable launching and recovering the SOLAS boat? Answer: Yes and no.

The 11 m RHIB stern ramp is dangerous, but the BM1 is experienced, which mitigates the danger. The ramp is the problem. It would be better to pick the boat out of the water so that you do not have to deal with the angle of the ramp.

Preventive Maintenance

The shoreside maintenance support team (MST) was supposed to help us, but they are useless. They help with manning the quarterdeck CDO watch in port. ET1 Teel is doing his best to help, but he is the only one that's even trying to help us. On the first of August, the Coast Guard guys leave and are replaced with 5 MST guys. Once the Coast Guard leaves, we will have to go to a 3-duty section rotation in port.

Top Things You Would Want to See in a Coast Guard Sea Fighter-like Vessel?

- A fuel oil purifier is needed. This will make the ship last longer.
- The spoilers installed in January–February this year by the gas turbine exhaust are causing exhaust fumes to be sucked into the Mission Bay. They were added to remove heat from the CO_2 storage room, which was heating up.
- Retain the Crew's Lounge. Officers and crew eat together on Sea Fighter, which is something he has never seen.
- The T-foils at 50 knots are loud, but it is unknown how to muffle the noise.

- The 26-person crew size is too small. It is unclear what the appropriate crew size should be. Maybe 50? Maybe 60? Increasing the crew size will reduce stress on the crew in port.
- Electronics problems (false alarms) are always an issue.
- Need a ship's store.
- Underway is boring because there is no place to go while off-watch. There are only four places to go: the Bridge, the Mess Deck, the Crew's Lounge, or the Mission Bay. In addition, as the oil king he can go to the oil lab. On his last ship, he could go to many spaces, including the Log Office, check e-mail, go to the berthing area, ship's store, Smoking Deck, Flight Deck, etc.

D.7 Observations of Operations Notes (observers names redacted)

The Sea Fighter conducted two weeks of dedicated Coast Guard OT&E during the periods 1 to 4 May 2006 and 8 to 11 May 2006. Five R&DC representatives observed these operations as shown in Table 1. The operations included Coast Guard mission exercises (Maritime Domain Awareness (MDA), Law Enforcement, Search and Rescue (SAR), and Alien Migrant Interdiction operations (AMIO)), flight operations, vertical insertion of a Maritime Safety and Security Team (MSST), and a main space fire drill. In addition, special sea and anchoring detail was observed during the transits in and out of port, and the conduct of the Bridge Management Team was observed. Telephone interviews of the HH-60 pilots, HH-65 pilots, and senior members of the MSST who participated in these exercises are contained in Section D.8. This section contains the post sailing reports of the R&DC representatives who observed operations underway on Sea Fighter during the periods 1–4 May 2006 and 8–11 May 2006.

Table D-5: Sea Fighter Observed Operations

Date	Event	Observer
1–4 May 2006	Flight Operations (HH-60)	Officer, USCG; Enlisted, USCG
1–4 May 2006	MSST Operations	Officer, USCG; Enlisted, USCG
8 and 11 May 2006	Special Sea and Anchor Detail / Mooring	Officer, USCG; Enlisted, USCG; three R&DC Representatives
8–11 May 2006	Bridge Resource Management	Officer, USCG; Enlisted, USCG; three R&DC Representatives
8–9 May 2006	MDA Exercise	Officer, USCG; Enlisted, USCG; three R&DC Representatives
9 May 2006	Flight Operations (HH-65)	Officer, USCG; Enlisted, USCG; three R&DC Representatives
9 May 2006	Law Enforcement Exercises	Officer, USCG; Enlisted, USCG; three R&DC Representatives
9 May 2006	Main Space Fire Drill	Officer, USCG; Enlisted, USCG; three R&DC Representatives
10 May 2006	SAR Exercise	Officer, USCG; Enlisted, USCG; three R&DC Representatives
10 May 2006	AMIO Exercise	Officer, USCG; Enlisted, USCG; three R&DC Representatives
11 May 2006	Law Enforcement Exercise	Officer, USCG; Enlisted, USCG; three R&DC Representatives

D.7.1 Observations of Enlisted, USCG

Observations of operations underway on Sea Fighter during the period 1–4 May 2006 and 8–11 May 2006 as documented by Enlisted, USCG are contained in the following sections.

Introduction/Background

- Experience: West Coast – WESTPAC, Persian Gulf; East Coast – Caribbean, UNITAS
- Years in Service: 21
- Seagoing Time: 4 years Navy, 6 years Coast Guard
- Vessels Served On (and Duties): FF-1066, LPO on FFG-54, Weapons Division Chief/CIC Watch Supervisor on WMEC-911
- Time onboard Sea Fighter: Week-long evaluation periods, both UW and moored

Observations

Not able to evaluate CIC due to equipment/lack of installation limitations. Bridge crew is adequate for point-to-point transits, but not enough personnel onboard to maintain a rested watch rotation for ANY other evolutions. I noticed a drain on the crew after any extra evolution and especially after only 3 days at sea. SOLAS boat launch is only capable in calm seas with extra personnel and required 4 extra people to recover if needed.

I do not like its launching system and question the safety of the system in a real emergency situation. RHIB launches (when working) were good, but questions as to load/personnel limits have not been answered, and recovery and winching were questionable if a reliable system is needed. Never saw the RHIB and cradle moved and stored via the X-Y crane. Anchoring evolution was smooth; not that many personnel required.

Habitability is adequate, but not initially configured for mixed-gender crew with the large enlisted Male head.

Ride at speed was outstanding; one of the major capabilities of this type of vessel, along with maneuverability. Ride while moving slowly was noticeable in both pitch and roll, and if drifting in higher sea states.

UW use of X-Y crane not observed; clearance limitations of Conex boxes noted. Mooring capability and limitations are a drawback; RO-RO capability was never demonstrated. Modular payload bay was a definite asset; ability to add crew berthing module, etc., is also a major capability. Not sure if the Flight Deck elevator is the best use or best design.

Aircraft hosting is still an unknown, but minimal crew was able to perform Flight Deck requirements without any problems (Flight Deck AFFF spray is a benefit) – as long as they wouldn’t be required to do anything else for long periods of time, like drive the ship, and they were barely manned for that. There really are not enough personnel onboard to do anything but drive the ship. The minimal manning of the Sea Fighter crew was unique. This can be a problem for the assigned personnel (E-5 up to LTs) who may be required to perform duties usually assigned to non-rates, but a tight crew can overcome this limitation as long as all the

crew participates. Maintenance should not be a problem, as long as sufficient spares are available and not located in a different country on the other side of the world.

Overall, the ship is a much better multipurpose platform than current cutters, but some shortfalls would need to be addressed prior to using this type of platform in the future.

D.7.2 Observations of R&DC Representative #1

Observations of operations underway on Sea Fighter during the period 8–11 May 2006 as documented by R&DC Representative #1 are contained in the following sections.

Bridge

I thought the Bridge was cramped and very noisy. The OOD or CO could not walk from the starboard to the port side of the Bridge without having to walk behind the EOW console. Even this path could be difficult, depending on the placement of the EOW chair. The addition of other crew and observers on the Bridge made moving around even more difficult.

I also thought the noise level on the Bridge was very high. This was due to several factors, including noisy AC units, key crew members (CO, XO, Navigator, OOD, and EOW) trying to conduct essential business on the Bridge, and the Bridge being the only access way onto the Flight Deck.

I'm not sure I like the CO being in between the OOD and the NOW. The CO had good operational picture, but it was confusing who was in charge – the CO or OOD. I found that when the CO was on the Bridge, most of the Bridge watch (including the OOD) passed all information through him and not the OOD.

The OOD, CO, NOW, and EOW consoles all seemed to be designed well. I was particularly impressed with the EOW console. The EOW could control 90 percent of all engineering functions from this console. However, I'm not sure I would keep the EOW on the Bridge. The extra set of eyes on the Bridge is nice, but the extra noise and additional space is a minus. During certain evolutions, the EOW would need to get into lengthy and sometimes loud discussions with the Rover Watch either on the Bridge or via the phone systems.

At night there seemed to be a great deal of excess light from the consoles. The crew would place light-damping devices (paper, rags, and various dark transparencies) over many controls and indicators. The windows seemed to be angled in such a way that at night you would get a good amount of glare from the consoles.

Radio communications on the Bridge were spotty at best. It seemed we could not transmit or receive with several vessels participating in our exercises at close range. We had to use the satellite phone several times to communicate with these vessels. Even using the satellite phone was awkward because it was attached/tethered to a short external antenna. In addition, radio communications were very difficult to hear on the Bridge. This was probably due to the excessive noise on the Bridge. The radio was placed such that the OOD and the NOW were the only ones who could reach it – even they would have to stretch to get the handset.

I did not observe the Bridge watch with an operational CIC or tactical officer. As the Bridge is configured now, I am concerned that these elements would add to the noise and crowdedness.

Engineering

The engineering plant seemed to work well during our OT&E testing period. Most spaces were tight, but you could maneuver about. Access into most spaces was through a tight vertical hatch. In poor weather conditions, opening the heavy hatch and entering the spaces could be a safety concern.

Most engineers loved the engineering console – it was impressive how much functionality and control over the engineering plant the EOW had. The biggest complaint from most of the engineers was the fuel-filtering system not being adequate.

Damage control drills went well, with the exception of entering some of the engineering spaces. Again, the small and heavy hatch makes access in full DC gear a challenge. There are Scott Air-Packs and a few other pieces of DC equipment scattered through the ship; however, there is only one real DC locker.

Mooring

Mooring evolutions went well. The ship seemed to handle very well to helm and engine commands. Rigging the mooring lines is a bit of a challenge for the crew, especially up forward. To rig the forward lines, they must walk out on a catwalk on the bow and swing the line to chocks on the port or starboard side. In the mooring I observed, it took three attempts to swing the line into the proper place. This evolution in poor weather would be a safety concern.

I observed both starboard and port moorings. The ship tends to tie up on the port side. The port side is the only side with access to the Mission Bay (via a large hatch on that side of the ship), and the Bridge is also offset to the port side (making the starboard side blind to the OOD). When mooring to the starboard side (because of the position of the Bridge), the OOD seems to be more dependent on cameras and phone talkers relaying positions in relation to the dock. The OOD has the ability to maneuver the boat from a remote station that can be used on the Flight Deck (forward or aft), but the Sea Fighter OODs have never used the system. I was told that the system was only used once by a pilot.

Finally, because of the shape of the hull at the waterline, the ship needs to use very large fenders, which the ship does not get underway with and are not available at many peers. This could limit the number of ports the ship can pull into.

Flight Operations

I observed several flight operations, including refueling operations. They all seemed to go very well. Because of the fire suppressant system on the Flight Deck, Sea Fighter uses a relatively small number of people for flight operations. Operations on the Flight Deck were very well choreographed and organized. I observed both single helicopter and two helicopter (one landing minutes after the other) recoveries. I also observed both hot and cold refueling.

Small Boat Launch and Recovery

The 11m RHIB was OOC during my observations period and did not make the patrol with us. No small boat operations using the stern ramp or the SOLAS boat were performed. The only small boat operations I observed were with the Alameda Sheriff's boat. In this evolution, the

Alameda Sheriff's boat transferred people via a Jacob's ladder to and from Sea Fighter. Because of the shape of Sea Fighter's hull, the ladder was not resting against the hull of Sea Fighter (it was hanging, not resting against anything), and transferring people was difficult for the crew and exhausting for the people going up and down the ladder. In addition, the small boat had difficulty staying alongside Sea Fighter. The shape of the hull makes it difficult and dangerous to allow small boats to ride against the hull – if Sea Fighter rolled significantly, they might be trapped or crushed.

Ride Quality

In the short time I was aboard the Sea Fighter, we did not encounter any bad weather or even moderate sea states. The ride seemed fine. The ship pitched more, especially at slower speeds, than I have encountered on other ships. Also, the rolls and pitches seemed a little more random, sharp, or snappy. As the ship's speed increased, I though the ride generally got better. Several times Sea Fighter was making between 40 and 50 knots, and the ride seemed very good.

Speed and Maneuverability

I was impressed with speed and maneuverability of Sea Fighter. The ship could quickly (in a few minutes) go from 10 to 50 knots and easily maneuver at high speeds. In all our chase-type exercises the Sea Fighter did very well. The Sea Fighter consistently intercepted targets going between 30 and 40 knots. This impressive record was in spite of some poor tactics by the crew. (Poor tactics are not a reflection of the crew, but a function of training and a lack of a functioning CIC or tactical officer.)

Modularity

I did not observe any modules being loaded or unloaded. I did observe the elevator in use. It worked fine. The biggest complaints by the crew about the X-Y crane were that it was temperamental and often need ad hoc repairs. In addition, you could not move any modules while underway (loads would swing out of control). The only complaint about the elevator was that in did not rest flush with the Mission Deck while in the down position. This made moving smaller, heavier items (without using the X-Y crane) more difficult – the crew often rigged a temporary ramp to dolly things off the elevator.

Habitability

I thought living conditions on Sea Fighter were generally good. The Galley was adequate for the size of the crew. The number of heads and water usage were not issues. The berthing spaces seemed a bit tight for 3 people; I stayed in a 12-person berthing module, but I did tour the crew berthing spaces. Two people could not dress at once in the crew's berthing. Only the officers had room for a chair and a pull-down desk. This seemed to be an issue for some crewmembers, since there were a limited number of places the crew could escape to or relax in.

The ship converted the wardroom into a ship's lounge – this was appreciated by the majority of the crew. The only spaces the crew could relax in were the lounge or the Mess Deck. Both tended to be crowded and noisy. Again, it seemed difficult to find a quiet space on the ship.

There was only one ship's office, which was very small. The Mission Bay had a great deal of room, but it was very noisy underway.

I also noticed the lack of weather decks. In fact, there were only two places you could go to get fresh air: aft by the waterjets or on the Flight Deck. The aft weather deck was very noisy (hearing protection was always required near the waterjets) and very wet (during high-speed operations). The Flight Deck was large, but it was also windy and was secured during high-speed operations. In addition, you would have to pass through the Bridge to get to the Flight Deck and were in complete view of the Bridge – not very private.

Manning

One of the biggest complaints the crew had was about the lack of manning on the ship. The crew size seemed adequate for transiting from point A to B. However, most evolutions like flight operations required all hands. I can't imagine fatigue not being an issue in a moderate operations tempo. Multiple boardings, special sea details, and/or flight operations would quickly take their toll on this size crew.

D.7.3 Observations of R&DC Representative #2

Observations of operations underway on Sea Fighter during the period 8–11 May 2006 as documented by R&DC Representative #2 are contained in the following sections.

Special Sea and Anchor Detail / Mooring

The #1 and #2 mooring lines are put over from the forward mooring station located on the fo'c'sle. Since the Mission Bay side door is on the port side, the Sea Fighter normally moors port side to the pier. The #1 line is led through the port bow chock. The #2 line is led through the chock on the port side near the bow. In order to throw a heaving line for #1 line to the pier, a crewman must go outside through the bow hatch, walk along the narrow catwalk on the bow to the port side, and throw the heaving line that has been tied to #1 line and led through the bow chock to another crewman standing in the open area on the port side fo'c'sle. As the ship nears the pier, the crewman standing in the open area on the port side fo'c'sle then throws heaving lines for #1 and #2 lines to the linehandlers on the pier. The picture below illustrates the bow hatch, bow chocks, port and starboard chocks, bow catwalk, and the open area on the starboard side fo'c'sle, which is duplicated on the port side.

Sending a crewman outside the ship onto the narrow bow catwalk is considered unsafe by the crew.

Special Sea and Anchor Detail is set during transits in and out of port. As the ship leaves (or approaches) the pier, a crewman stands up in the bow hatch with a range finder and provides ranges to the pier and to the other vessels moored nearby to the OOD. The OOD uses the joystick to control the ship's speed and for steering the ship during the period of restricted maneuvering.

Bridge Resource Management

The following resources are available on the Bridge to ensure safe operation of Sea Fighter:

- Electronic equipment (e.g., radar, depth sounder, GPS/DGPS, ARPA, gyro, compass)
- Electronic Charting and Display Information Systems (ECDIS)
- NAVTEX (text weather message) and instruments/information regarding environmental factors (tide, wind, currents)
- Internal and external communications equipment
- Automatic Identification System (AIS)
- Bridge personnel (CO, OOD, NOW, EOW)

Occasionally, Bridge resource management is not totally effective. This is especially noticeable when the Bridge Team has multiple simultaneous tasks.

At night, several displays and monitors have to be covered with towels because they are bright and cannot be dimmed. The noise level also distracts from effective Bridge resource management. Sources of excessive noise include:

- Two air-conditioning units located on the port and starboard sides of the Bridge
- Movement of the chairs for the OOD, CO, NOW, and EOW
- Off-watch crewmembers who congregate on the Bridge
- Break-in Bridge watches, which increase the number of personnel on the Bridge and the necessary verbal communication associated with learning the watch

MDA Exercise

A Maritime Domain Awareness (MDA) exercise was conducted on Sea Fighter overnight starting on 8 May 2006 and concluding the morning of 9 May 2006. The Sea Fighter acquired, tracked, and classified all targets encountered during the exercise. Every 30 minutes, the Sea Fighter provided an "Alpha report" to Sector Los Angeles. This report contained ship's position, course and speed, quantity of contacts detected in the preceding 30 minutes, and quantity of contacts classified. The contacts were typically classified using ARPA and AIS.

Main Space Fire Drill

A main space fire drill was conducted from 1420 (announcement of drill) until 1500, when the drill was secured. The alarm of fire in the port main diesel engine room (MDE) was sounded at 1430; at 1436 ten crewmembers were assembled in the Mission Bay. The firefighting party dressed out appropriately for their roles. Ventilation was properly secured, and investigators went fore and aft of the port main diesel engine room space checking for heat. Two hose teams were manned – one with water, one with aqueous film forming foam (AFFF). At 1445 a hose team entered the port MDE space with a hose (water). At 1447 the fire was contained; it is unknown if the CO_2 system was used to extinguish the fire. If the CO_2 system had been used, the hose team entered the space without oxygen breathing apparatuses (OBAs).

Based on observing the drill, it was apparent that the crew does not perform main space fire drills frequently. It is unknown if the fire was Class A or Class B. Class B fires are more common in machinery spaces, and Class A fires are more common in accommodation spaces. The appropriate agent for a Class B fire is either CO_2 or AFFF. The hose team that entered the space was prepared to apply the firefighting agent (water) appropriate for a Class A fire. The firefighting team was enthusiastic and took the drill seriously. There was no debrief or critique of the drill that was designed to improve performance in future drills.

Law Enforcement Exercise

The scenario for the law enforcement exercise involved receipt of intelligence of a high-speed (go-fast) target leaving the port of Los Angeles. There was some tracking information that showed the target south of Catalina Island. The Sea Fighter had operational control of the CGC *Halibut*, and the Alameda County Sheriff's boat played the role of the high-speed go-fast target that tried to evade detection and interception. Air assets were not used, and since the RHIB is not functional on Sea Fighter, the *Halibut*'s RHIB was used to effect the end game of boarding the target.

In this exercise the Sea Fighter used the CGC *Halibut* as a "gatekeeper" to locate and track the target and attempt to intercept. The Sheriff's boat is capable of 45 knots, which exceeds the CGC *Halibut*'s maximum speed.

The Sea Fighter intercepted the target, and the *Halibut* launched their RHIB and boarded the target as shown in the accompanying picture**.** The Sea Fighter pursued the target in autopilot, including the interception phase. While the target was attempting to evade, the Sea Fighter used the autopilot to turn the vessel. Eventually the Sea Fighter shifted to manual steering. Sea Fighter could have intercepted the target more quickly if they had shifted to manual steering earlier.

Another law enforcement exercise was planned for the morning of 11 May 2006. This exercise involved an air asset (HH-65) under Sea Fighter control. CGC *Halibut* was to play the role of a drug-running mothership with associated go-fast small boats. The Alameda County Sheriff's boat was to play the role of a legitimate fishing vessel. The helicopter never launched, the Alameda County Sheriff's boat had to return to base due to low fuel, and Sea Fighter was very busy with contacts, so this exercise was not conducted.

SAR Exercise

The scenario for the Search and Rescue (SAR) exercise involved a vessel on fire that resulted in a person in the water (PIW). The Sea Fighter responded to the mayday call and used local assets to find and recover the PIW. CGC *Halibut* and an HH-65 helicopter were the local assets available to assist Sea Fighter.

The exercise was supposed to begin in the morning of 10 May 2006; however, low visibility that morning necessitated the use of the Sea Fighter's fog horn and delayed launch of the HH-65. However Sea Fighter was still proceeding at 20 knots on diesels through Santa Cruz Channel between Santa Cruz and Catalina Islands.

At 0805 visibility had improved. The Sea Fighter switched from diesel to turbine mode and proceeded at 40 knots toward the location where the mayday call was reported. Sea Fighter's intentions were to then proceed east for 6 to 10 miles, which is the distance and direction the PIW would have drifted for the two hours since the mayday call was received. At 0855 Sea Fighter notified Sector Los Angeles that it was in the vicinity of the mayday call and was commencing to search. The Sea Fighter mustered a SAR team on the Mission Bay. The Sea Fighter located the PIW and vectored the helicopter to pick up OSCAR, since the Sea Fighter could not launch their RHIB. The Sea Fighter set flight quarters and recovered OSCAR from the helicopter.

During this exercise as well as others, it was apparent that VHF communications is occasionally an issue on Sea Fighter. The Alameda County Sheriff's boat could sometimes receive and transmit traffic on Channel 16 that Sea Fighter, in close proximity to the Sheriff's boat, could not receive. The morning of 11 May 2006, Sector Los Angeles had to relay comms traffic from Sea Fighter to the Sheriff's boat. The Sea Fighter attributed this problem to "atmospherics."

AMIO Exercise

The AMIO exercise was conducted from 1305 to 1354 on 10 May 2006. The scenario involved the Alameda County Sheriff's Boat transferring "migrants" from their boat to the Sea Fighter using their RHIB. Because only one migrant was transferred onboard Sea Fighter, Phil Muir, Senior Chief Backs, Mike Sprague, and Lou Steinbrecher played the roles of four additional migrants.

Migrants were brought onboard through the port side door on the Mission Bay via a Jacob's ladder rigged through the side door. Because of the flare of the hull on Sea Fighter, climbing the Jacob's ladder is very difficult and can only be done by a healthy person without disabilities. The crew took this exercise very seriously and demonstrated how the Sea Fighter would deal with a limited number of migrants. The garage doors (currently inoperative) would be needed to help contain the migrants on the Mission Bay.

Flight Operations

Preparations for flight operations involve several crewmembers lowering the Flight Deck nets; removing the port, starboard, and aft 50 caliber machine gun mounts (the forward mount is not removed); and conducting a thorough inspection of the Flight Deck for foreign objects.

When flight operations are announced by the Bridge, the following personnel report to the Flight Deck: one Landing Signal Enlisted (LSE), two chock-and-chain men, and three hot suit men. These six persons are appropriately dressed, including a colored vest that indicates their roles. Other personnel involved in flight operations include the Helicopter Control Officer (HCO) in the tower above the Bridge and two ready boat crew (coxswain and engineer) who muster on the Mess Deck; additional personnel are available to assist in refueling the helicopter if needed.

The HCO communicates with the helicopter via radio. The LSE communicates with the pilot via hand signals. The LSE controls the movements of the chock-and-chain men based on a signal from the pilot. The chock-and-chain men install or remove the chocks and chains around the main landing gear.

Refueling an HH-65 helicopter on Sea Fighter involves opening the deck hatch on the port side of the Flight Deck and pulling the refueling hose out of the refueling pit across the Flight Deck to the starboard side of the HH-65. Refueling takes approximately 10 minutes to transfer 160 gallons of JP-5 fuel. The refueling hatch is heavy, and the refueling crew is careful not to be under the hatch while it is open. This hatch is not visible in the picture.

This picture illustrates the ability of Sea Fighter to accommodate two helicopters on deck simultaneously. The forward helicopter had shut down its rotor, and the aft helicopter was in the process of being chocked and chained after landing. The speed of the Sea Fighter was approximately 12 knots. The Sea Fighter is not likely to operate at high speeds with a helicopter on deck due to possible damage to the rotors.

The CO makes the decision to turn the Flight Deck from “red deck” to “green deck,” indicating it is safe for the helicopter to either land or take off. There was some confusion regarding when to announce “red deck,” which can be announced by any crewmember. The HCO was hesitant to announce “red deck” as soon as the helicopter landed because he felt this would permit the OOD to maneuver the Sea Fighter while the chock-and-chain men were in the process of applying chocks and chains.

The HH-65 helicopters that landed on Sea Fighter made approaches from the stern, port quarter, and starboard quarter, landing on a 45-degree angle as shown in the picture for a port quarter approach.

D.7.4 Observations of R&DC Representative #3

Observations of operations underway on Sea Fighter during the period 8–11 May 2006 as documented by R&DC Representative #3 are contained in the following sections.

SOLAS Boat

Setup of the boat is not very practical for use in rescue/recovery of MOB.

Thwarts take up too much space in the boat and get in the way of MOB recovery (only need small seat above bas tank for the rescue boat driver to sit on).

Arrangement of davit and rescue boat on vessel is not optimized for launching the boat. Better access to the side of the ship is needed to enable use of bow and stern painters. Current arrangement makes it difficult to swing boat out alongside side the vessel and embark/disembark the boat.

A better designed boat station and davit system is needed for safer operation of the SOLAS boat.

Vessel Arrangement

The arrangement of equipment in the spaces is similar to other high-speed vessels (car ferry, passenger ferry).

Wheelhouse (Bridge)

Sea Fighter has more than adequate space in the wheelhouse for safe operation of the vessel based on its manning requirements. The chair systems installed currently take up too much space at the after-watch stations, restricting personnel movement. With the chairs all the way back, personnel cannot pass between the chair and plotting table. The only access to the Flight Deck while underway is through the wheelhouse. This can be disruptive to the Bridge Team.

The navigation equipment is generally good except for fathometer, engine controls, and external communications. The fathometer is at the engineer's station instead of one of the operators' stations (there was a repeater in the overhead that could be seen from the forward stations). There is only one set of T-handled engine controls (combinators – throttles and waterjet bucket controls) located on the right side of the center console. These controls are out of the reach of the NOW operator's station (this arrangement could possibly based on a philosophy that the OOD only operates the controls, but the NOW operator's station has the joystick controls and can operate the vessel using this joystick). This lack of redundancy could be a problem if the engine controls fail; there is no second set of controls in the wheelhouse to operate the vessel. The only other set of engine controls is at the Engineering Operating Station off the Mission Bay above the starboard diesel engine room. This station is unmanned. (The joysticks could possibly used if the T-handled controls failed, but the priority of the controls is not known; usually the joysticks are lower priority than the T-handled controls.)

External VHF communications between Sea Fighter and other vessels and the Sectors appeared to be problematic. Although transmissions from Sea Fighter appeared to reach the intended contact, communications to Sea Fighter had to be relayed through the *Halibut* and the Alameda Sheriff's boat, which were operating in the vicinity, to Sea Fighter.

Mission Bay

The Mission Bay is spacious and seems more than adequate for Coast Guard missions, but needs better system to close off from stern of vessel. Berthing modules along with the head located in the Mission Bay work well for additional riders that may be needed to augment the crew. A temporary wall system could be developed to close off part of the Mission Bay that is not in use for use as additional crew recreational areas when space is available.

Living Spaces

Crew cabins are small. More crew recreational space would probably be needed for a deployed vessel, as the crew's mess and lounge are the only common areas on the vessel and most outside spaces are off-limits or too noisy to use.

Storage

Sea Fighter has many spaces that are large but are underutilized and could be used for ship's stores (supplies, spare parts, equipment). Lockers could be added to these spaces and the two containers used for this purpose eliminated, freeing up space in the Mission Bay.

Seakeeping

Sea Fighter acts much the same as other multi-hull vessels (SLICE, catamaran ferries). Motions are more pronounced at speeds below which the active ride control system can damp the motions. Although we were in relatively calms seas, the ride control system worked well. (If the crew was more familiar with the system, the ride at slower speeds could have possibly been better by adjusting the ride control – no adjustment to the ride control system was observed.)

Ship Handling

The crew used the joystick in Harbor mode for docking and undocking, which simplifies these maneuvers because the system adjusts the waterjets automatically based on joystick position. This system worked well for these maneuvers.

While underway the crew mainly used the autopilot to control the vessel and the combinators when not using the autopilot. Although the joysticks could be used for control of the vessel at-sea, they were not used. Based on the crew's reliance on the autopilot (it steers a better course), the crew has not become proficient with the use of the combinators and joysticks (crew was using autopilot to chase vessel during scenario).

Bridge Resource Management (BRM)

Although there is evidence that the Bridge crew was properly trained in BRM, through lack of underway time and training, the crew's BRM was lacking. BRM breaks down when situations out of the ordinary occur. Communications between Bridge Team members was often confused, unacknowledged, and at times nonexistent. Often extra crew would congregate in the wheelhouse, causing too much noise. The responsibility of each team member was not clear, leading to confusion during scenarios (SAR, fire drill, etc.). The watch bill did not have the

responsibilities of crew members for different situations (fire, man overboard, etc.). During the SAR exercise, lack of coordination of communications and SAR planning caused confusion and delay. The CO reminded the crew to observe protocol with Bridge communications to avoid the confusion. During the fire drill, the EOW handled all communications along with shutting down systems. The rest of the Bridge Team appeared as though they had no role exercise, when they should have been handling external communications, best positing of vessel for firefighting, closest port of refuge, any vessels in the vicinity with the ability to assist, and preparations for evacuation of the vessel if needed. This breakdown of communication between Bridge Team members is unacceptable when operating at high speeds. There were times when both the OOD and NOW were looking down at their instruments with no one looking out the window while operating at speeds close to 50 knots.

Flight Operations

The crew handled flight operations very well except for one issue – when to call “red” and “green” deck. The efficiently and effectively landed and hot refueled the HH-65 aircraft that performed landings on the Flight Deck. A total of eight crewmembers were used for flight operations in addition to the Bridge crew. There were six crewmembers on the Flight Deck: two chock-and-chain, three firefighting, and one LSE. There was one helicopter control officer in the tower and a crew member was located under the deck hatch at the fueling station.

Mission Prosecution

AMIO

The crew handled the AMIO scenario well. They put together a good team to process the migrants. Getting migrants onboard would be difficult based on the hull design, and any Coast Guard version would need to remedy this. The large volume of the Mission Bay makes it possible to feed and care for a large number of migrants, although it would be difficult for the small crew.

Drug

Sea Fighter has the speed to intercept most vessels and has the ability to use their RHIB to board suspect vessels. Sea Fighter was able to intercept the suspect vessel. Unfortunately, the RHIB was broken and could not be used to board.

MDA

Sea Fighter was successfully able to detect, track, classify, and identify targets in its area of operation through use of their ARPA Radar and AIS.

D.8 HH-60 and HH-65 Pilots and MSST Interview Notes (interviewees names redacted)

Coast Guard Air Station San Diego provided HH-60 helicopters, and Sector San Diego provided an MSST that participated in exercises with Sea Fighter during the period 1–4 May 2006. Coast Guard Air Station Los Angeles provided HH-65 helicopters that participated in exercises with Sea Fighter during the period 8–11 May 2006. Telephone interviews of the HH-60 pilots, HH-65 pilots, and senior members of the MSST who participated in these exercises are contained in this section.

D.8.1 Interview of Officer, USCG

This interview was led by Craig Schnappinger; interview notes were recorded by Mike Sprague. LT Matthew Hammond participated in most of the interview (joined the interview 15 minutes after it started). These notes represent as close as possible the words spoken by Officer, USCG. Additional words are added in square brackets [ ] if necessary to improve the clarity of his responses. Officer, USCG presented some additional input provided by other pilots at Air Station Los Angeles who landed on the Sea Fighter. Their input is appended to these notes.

Background

Officer, USCG was the copilot on two HH-65 helicopters that conducted flight operations on the Sea Fighter (tail numbers 6567 and 6590). He had previously conducted 51 (day and night) landings on Coast Guard cutters; most of these were on 378' WHECs. However, he has never been deployed on a cutter for a patrol.

Sea Fighter's Flight Deck

Compared to a 378' WHEC Flight Deck, Sea Fighter is far superior. There is more room, and the superstructure on Sea Fighter does not block the pilot/copilot view of the horizon. Of the three possible approaches (port and starboard quarters and stern) the stern approach is preferred because both pilots have an excellent view of the LSE. The Sea Fighter's speed of advance was approximately 10–15 knots. The platform is so big, the aircraft was in ground effect; therefore the ship did not have to go faster. The Sea Fighter is capable of much higher speeds, which would increase wind over the deck. This would be preferred if it did not adversely affect roll and pitch; 45 knots would be acceptable as long as roll and pitch stay within limits.

The pitch and roll of the ship provided by the HCO is definitely inaccurate. For example, when the ship said the pitch and roll was 0 and 1 [degree], actual pitch and roll were closer to 4 and 2 [degrees].

Pilots would prefer a talon grid. Pilots would also prefer high tie-down straps to chains on the landing gear.

Hot and Cold Refueling

Officer, USCG participated in hot and cold refueling of an HH-65 with a mixed Navy/Coast Guard crew on Sea Fighter. This crew was not totally familiar with an HH-65 helicopter; an all-Coast Guard crew would be expected to be better and faster. Due to the location of the fueling pit hatch, the helicopter has to land at a 45-degree angle (aircraft nose to starboard and tail to port) in order for the pilots to keep sight of the refueling nozzle.

Flight Deck Crew

The Flight Deck crew on Sea Fighter is greatly reduced compared to a 378' WHEC, what are your impressions of the Sea Fighter Flight Deck crew? The crew did a good job, and they work well together. For example, there were two chock-and-chain men; both would approach from the port side and then one of them would go around the nose of the aircraft to chock the starboard landing gear. The LSO was not wearing NVG for the night landings, so we turned on the [helo landing] lights to help him. It is standard procedure for pilots to wear NVGs for night landings when there is no visible horizon.

Two Helicopter Operations

Landing two HH-65s on Sea Fighter was definitely a unique experience. This was accomplished by landing helicopter #1 on the forward pad and shutting down the rotor and applying chocks and chains. Then helicopter #2 landed on the after pad. In retrospect, the forward helo could have continued rotor engagement. Officer, USCG was asked if he would prefer a hangar over a larger elevator on Sea Fighter. He would prefer a larger elevator and the cleaner air that a lack of hangar would provide; however, a traversing system would be needed to move the helo onto the elevator for lowering into the Mission Bay.

Officer, USCG asked other pilots at Air Station Los Angeles the following question. (Their answer follows the question.) Would you prefer a hangar or an elevator system that lowers the helo into the cargo area? “Either option is acceptable. Ideally the aircraft should be stored in the same location as the HSK. Having an elevator system that meets these requirements would guarantee deck size remains unchanged. The only other requirement would be to ensure the cargo area is sealed from the elements and has environmental control.” Another pilot added: “I’m sure the engineers would prefer a hangar – an elevator system would be cool. As long there is enough fresh water to wash the aircraft every day, I’d be all right without. Plus I think the deck is higher than most CG cutters and the Sea Fighter would create less sea spray.”

Flight Deck Lighting

The Sea Fighter Flight Deck lighting system is the best they have ever seen. There are no blind spots, no halo effect, depth perception is good, and intensity is good. Some of the monitors in the EOW work station on the Bridge are really bright. Existing lineup lights are on both obliques; would prefer lineup lights that would facilitate a stern approach as well.

Sea Fighter Manpower Issues

The Sea Fighter would be a great LE platform due to its large Mission Bay. The minimal number of Sea Fighter crew, however, would make it difficult to stand up 24-hour-a-day watches over migrants brought onboard while on AMIO patrol.

Deploying on Sea Fighter

Pilots would not be opposed to deploying on Sea Fighter for a patrol. However, long-term deployments would require a hangar to provide protection from the weather for the helicopter. If the blades could be folded, and the helo washed down daily with fresh water, would that be sustainable? Yes, it would be possible, but not optimal.

If two helicopters were to be deployed on Sea Fighter, how many helicopter maintenance kits would you need to deploy, 1, 1.5, or 2? One HSK would be more than adequate (some items would be "plused" up, but this does not affect HSK status.

Additional Input from HH-65 Pilots at Air Station Los Angeles

The following is a transcript of the input received from other pilots at Air Station Los Angeles as provided by Officer, USCG.

Pilot #1

The Sea Fighter operations went pretty smoothly I thought. The crew seemed well organized, and the Flight Deck crew was professional and seemed to be well motivated. They did a good job operating with us. Comms seemed to work well on Ch 81. The Flight Deck characteristics were great when they were in their stabilization mode, pitch of 0 and roll of 1; however, at least for a short time while flying on Tuesday, when they were calling 0 and 1 for pitch and roll, it was more like 4 and 2 or something. I don't know if during that time they were maneuvering for better seas, but the pitch and roll were definitely beyond what they were calling. Fueling worked out great; no problems there. The structural layout of the boat from the Flight Deck was great; can't ask for a better landing spot.

Pilot #2

Sea Fighter has an outstanding Flight Deck for CG operations. The lighting is far better than the current standard on CG cutters. Fueling is easy, and the access door is centrally located in a good position for operations. The modular berthing areas would suffice for both Avdet berthing and possibly an avshack or office space.

The Flight Deck should have a talon grid and fore/aft lineup lines for standard CG procedures. Wheel chocks and chains are good, but high tie-down straps make operations much safer. The inclinometer on the Bridge seems to be on the conservative side (0/0 is probably more like 2/2). The LSO should have NVGs for NVG ops, and LSO should have direct comms w/helo & HCO. Without a hangar, or even a superstructure to block some of the sea spray, the helo will take some serious abuse during a deployment; 50 kts underway w/the helo tied down on the deck could cause some damage to the rotor system (don't know on that one; it will require the evaluation of our engineers).

It's a good LE platform, and the speed will give us a great chance to close down the maritime shipping of drugs. Minimal crewing makes it more difficult to stand up watch sections over the bad guys. Some other thoughts: Can she tow a boat? Can the Galley be enlarged to accommodate a larger crew? Where will the armament go? Can she carry more gas and more supplies for longer deployments?

Pilot #3

Thought boat has a lot of potential, I could see the Coast Guard using this boat. The hanger area below was extraordinary. Definitely a boat I would deploy on; my only concern would be for the 65 community possibly needing a talon grid. The boat movement was a lot different than that of our current fleet. The Sea Fighter fueling station was exceptionally good; I like the fact they use a dead man stick and the flight crew has full authority to shut fuel off at any given moment. Great boat, and I have been on over 15 cutters.

Pilot #4

After our brief tour, I thought it was a really good idea with the convex transport cases that could be converted and moved around below decks to accommodate different capabilities. The Flight Deck was huge, and I liked the lack of any superstructure in front of us. The ride wasn't as stable as I thought it would be, and I think their measurements of pitch and roll were not accurate.

D.8.2 Interview of Officer #1, USCG, and Officer #2, USCG

This interview was led by Craig Schnappinger; interview notes were recorded by Mike Sprague. Two Officers, USCG, of MSST San Diego participated in this interview.

MSST Operations

Three different operations were conducted with the MSSTs.

- Two MSST 25-foot RBS SAFE boats ran a grid pattern at different speeds to assess the ability of the Sea Fighter to track and train their weapons on the boats.
- The MSST's SAFE boats transferred three personnel to the Sea Fighter, and Sea Fighter transferred one person to one of the SAFE boats.
- An HH-60 transferred the MSST via vertical insertion onto the Sea Fighter's Flight Deck. The Sea Fighter was evaluated as a staging platform for an MSST.

MSST SAFE Boats

The Sea Fighter was easily able to track and train their 50 caliber machine guns on the SAFE boat, even at speeds approaching 50 knots. Sea Fighter was easily able to maintain station on the MSST SAFE boat at 40 knots. However if maneuvers were more drastic, such as tighter faster turns, the Sea Fighter would not have been able to maintain station. Officer #1, USCG, was asked if he would prefer to use an MSST SAFE boat or the Sea Fighter to chase down an uncooperative evasive target of interest. Officer #1, USCG, answered he did not know, but that different tactics would be required for different platforms.

At minimal Sea Fighter speed, three personnel were transferred to Sea Fighter from an MSST SAFE boat and one person was transferred from Sea Fighter to an MSST SAFE boat. The transfer of personnel via the Sea Fighter's Jacob's ladder showed that this is a dangerous method of personnel transfer due to the flare of the Sea Fighter hull. Neither the SAFE boat nor the Sea Fighter is considered a good platform for personnel transfers.

Vertical Insertion

Vertical Insertion on Sea Fighter's Flight Deck was accomplished without difficulty. The MSST remarked that moving about the Sea Fighter with all of their gear was especially easy compared to other Coast Guard cutters due to the generous width of the passageways and ladders. The Sea Fighter's Mission Bay is an excellent location for the briefings required of the MSST and for stowing their gear. Hearing protection is required on the Mission Bay, which is an impediment to conducting the briefings.

Eight persons are used at a minimum for boarding a target; all 16 are used for uncooperative targets. If 16 men are deployed on a target vessel using VI, two HH-60 helicopters are needed, since only 8 men and their gear can be carried in a single HH-60. The Sea Fighter is a viable platform to deploy an MSST, since it is capable of intercepting a target with its superior speed and can deploy the MSST via VI from its embarked helicopter(s) or via the 11m RHIB.

Is boarding a target of interest via VI or SAFE boat preferred? It depends on the size of the target. VI is preferred for boarding a small vessel, and the SAFE boat is preferred for a large vessel.

If Intel were to be received that a vessel carrying WMD is en route to the U.S., the desire would be to intercept this vessel as far away from the U.S. as possible. Coast Guard existing ships are too slow; the Sea Fighter could sprint out at 50 knots. Given this scenario, your MSST could be delivered by leapfrogging / refueling from one Navy ship to the next, or the MSST could be transported by Sea Fighter; which method would you prefer? It depends on weather and sea state. We would not want the MSST to arrive on scene seasick or fatigued. The Sea Fighter would permit more gear to be taken. There is also added flexibility with Sea Fighter being available as a SAR platform. There is no guarantee the last Navy ship used would be available as a SAR platform.

Consider Sea Fighter as a launch platform for your Team. The 11m RHIB on Sea Fighter could be used to deliver 5 persons by boat. VI can deliver up to 8 persons via HH-60. Therefore, if boats are used, ideally there would be multiple boats. Perhaps the Sea Fighter could be used to launch an MSST SAFE boat? While the Mission Bay is large enough to accommodate MSST SAFE boats, the stern ramp is an issue and the X-Y crane limits overhead space. The DOD designed a launch system for Special Forces on various vessels that uses an elevator instead of a ramp, permitting launches in excess of 30 knots. The Coast Guard could capitalize on this. Embarking passengers on Sea Fighter's small boats is a problem. The SOLAS boat on Sea Fighter is not a viable alternative. The platforms over the waterjets represent a hazard to Sea Fighter's small boats. The berthing module in the Sea Fighter's Mission Bay is adequate for the MSST.

MSSTs include divers who deploy with the Team along with all of their dive gear, which is loaded into 20-foot trailers that can be hauled by truck, loaded onto a ship, or into a C-130 aircraft. The MSST SAFE boats are trailerable as well. The trailers cannot be delivered by helicopter. The 20-foot trailer(s) would easily fit into the Mission Bay of Sea Fighter.

If an MSST were deployed on Sea Fighter and boarding via the Sea Fighter's 11m RHIB were contemplated, would the MSST prefer to operate the RHIB, or would you prefer the Sea Fighter to operate the RHIB? MSST coxswains receive extensive training for embarking a Team compared to typical coxswains on Coast Guard cutters. However, the MSST coxswain would require cross-training for different platforms.

D.8.3 Interview of Officer #3, USCG, and Officer #4, USCG

This interview was led by Craig Schnappinger; interview notes were recorded by Mike Sprague. Two Officers, USCG, participated in this interview.

Background

Officer #4, USCG, has 9.5 years Navy experience flying H-60 helicopters and landing on multiple platforms, including Navy ships and Chilean ships. On Sea Fighter, Officer #4, USCG, flew left seat (copilot). Officer #3, USCG, has never landed on a Coast Guard cutter. He received his qualifications on Navy ships, including Oilers and Fast Frigates.

Sea Fighter's Flight Deck

In conducting landings on Sea Fighter, the pitch and roll was reported as 1 degree of pitch and 1 degree of roll; however, pitch seemed much greater than 1 degree by the pilots. The HCO in the tower and the Bridge on the Sea Fighter reported different roll and pitch numbers to the pilots. When asked about the relative size of the Flight Deck to other ships they have landed on, they replied that the Sea Fighter "is as comfortable as it gets." Compared to landing on a U.S. Navy Fast Frigate, the visual aspect on Sea Fighter is better. In particular, landing behind the superstructure on a Fast Frigate creates turbulence that is not present whatsoever on Sea Fighter. The pilots prefer a stern approach on Sea Fighter because it allows them to judge the closure rate better, an oblique approach (port or starboard quarter) involves crabbing, which makes judging the closure rate more difficult. These pilots did not conduct hot refueling.

The builder of the Sea Fighter makes a claim that two HH-60 helicopters can be accommodated on the Sea Fighter's Flight Deck. The Sea Fighter reported that two Navy HH-60 helicopters landed on Sea Fighter during the period when Flight Deck certification was being conducted. Do you think Sea Fighter's Flight Deck is large enough to support two HH-60s? These pilots never landed on the after spot, but they believe there is plenty of room for two HH-60 helicopters.

The pilots reported they were comfortable with the Sea Fighter's streamlined Flight Deck crew of one LSE, two chock-and-chain men, and three hot suit men.

PWCS Mission Using Sea Fighter

A transfer scenario involves receipt of Intel that a target of interest carrying WMD is en route to the U.S. Ideally this target will be intercepted as far from the U.S. as possible. The Sea Fighter could be used as a lily pad from which to leapfrog to intercept the target with an air asset. Alternatively, the speed of the Sea Fighter could be exploited. How many 25' MSST SAFE boats would be required in this scenario? Probably none; the height of the boats would preclude loading them onboard Sea Fighter due to vertical clearance issues.

Sea Fighter currently has a small cargo elevator forward of the forward landing spot and no hangar. Would you (HH-60 pilots) prefer a hangar taking the place of the forward landing pad or a larger elevator that would permit lowering the helicopter into the Mission Bay and retain two landing spots? Lowering the helicopter into the Mission Bay would require the ability to fold the blades. This would afford protection from the weather and still retain the ability to land two helicopters.

Fast Frigates have two hangars (one above and one below). The policy on frigates is to never put both aircraft in the air if there was only one available Flight Deck. The only Coast Guard scenario that would require two helicopters is vertical insertion on a hot target. This scenario is being studied. Leapfrog is not ideal. Sea Fighter with two helicopters would be preferred. This would permit carrying more equipment, and there would be more room to pre-brief.

The aviation detachments would be onboard Sea Fighter 36 to 48 hours. In addition to spare parts for RHIBs and two HSKs for the helicopters, the following personnel would be required to support two aircraft and two 25' MSST SAFE boats:

- 4 maintainers
- 4 aviators per helo (total of 8)

- 16 MSST (fast ropers)
- 16 MSST (RHIB and weapons maintenance)
- 10 MSST (support)

These numbers are not in print.

The MSSTs have not standardized their spare parts kit. They use towable trailers for their divers' air tanks and spare parts for their 25' SAFE boats. The target for delivering an MSST should not be greater than 60 miles max range or 30 minutes flight time for the HH-60 carrying 10 people in the cabin with guns and gear, basket, and litter. There is very little room for the fast ropers. The element of surprise is important when using VI.

Communications

The comms package in a Coast Guard HH-60 is problematic. Our radios have problems because the Coast Guard used a Navy contract, and the Coast Guard is famous for using same antenna system with extra equipment. In general, UHF and data link is not a problem, and VHF is rarely used.

Desirable Features

If the Coast Guard were to acquire a Sea Fighter-like vessel in the future, what features would you like to see installed in the ship?

- Full IFR capability, including TACAN, Horizon Bar, etc.
- Larger envelope for flight operations (up to 3 degrees of pitch and 6–8 degrees of roll)
- Stronger Flight Deck that would permit greater than current limitation of 480 fpm descent
- Easily converted Mess Deck for briefings
- Full radio compatibility
- UHF in addition to VHF
- Ability to pass Intel reliably
- C-130 (SARSAT) 60 to 70 miles away from target. Should be line-of-sight.

Given the Sea Fighter's capability to operate at 50 knots, it would be relatively easy to create 35 knots of relative wind to permit landing on one engine in an emergency.

Admiral Johnson expressed a desire to deploy a Coast Guard helicopter for 30 days as an operational test. Since the HH-65 is constructed of plastic, it is not subject to corrosion in a marine environment. This is not the case for an HH-60 helicopter. What do you think? Both pilots would not like to see their HH-60 exposed to a 30-day salt bath. Plastics do not corrode, but the HH-65 community would still prefer a hangar. A lot of corrosion occurs in just three days in the Persian Gulf. If the HH-60 was embarked more than one day, it would be necessary to wash it down daily. High tie-downs and blade clamps would also be required due to the possibility of 70 to 80 knots of relative wind on the Sea Fighter's Flight Deck. The blades need to be booted above 30 knots. Ideally, the helo would be hangared above 25 knots.

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APPENDIX E. SEA FIGHTER PICTURES

This appendix is published separately on a CD-ROM due to the volume of the appendix.

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